Railway Mechanical Engineer

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Following up trial devices

A large share of the time of the mechanical engineer's office of the small railroad of today is spent in investigating the claims of manufacturers. The addition of this work has required in many instances, considerable reorganization of the mechanical enginering department, the most important feature of which has been the employing of additional men for the work of testing and trying out new devices and materials. Few small railroads possess a test plant or laboratory, although there are a number who own some equipment designed primarily for testing materials. It has been the practice on the majority of small railroads to test and try out new appliances and materials in actual service and to depend upon those in charge of the equipment and its maintenance to render a report whenever a locomotive or car on which an appliance or new kind of material is being tested, comes under their observation. Experience has shown that it is practically impossible to obtain accurate data from master mechanics or shop foremen. These men are usually too busy with the problems of operation to give mechanical engineer's problems much attention. Tests and investigations are of secondary importance to them and are given secondary consideration. One small railroad has overcome this difficulty by increasing the drafting room force and assigning some of its more experienced men to the work of following up trials of new appliances and materials. This system, which has been in operation for over two years, is giving satisfactory results. The investigation and following up of new appliances and materials placed on trial in actual service, requires men who have acquired both theoretical and practical knowledge. The employment of men having these qualifications together with the expense incidental to the carrying on of testing and investigation work, of course, requires an expenditure of money. It results, however, in bringing trials to definite conclusions, which they seldom reach without some such definite responsibility for their conduct.

Does modern shop equipment pay?

Elsewhere in this issue appears a description of the equipment and operation of a Boston & Albany flue shop at West Springfield, Mass. By modernizing the equipment in this shop, the total output per month now averages 5,550 flues, which are safe-ended at a cost of four cents per flue less than the cost when repaired with the retired equipment. This means an average monthly saving of $222, or for a period of 12 months a total saving of $2,664, and labor turnover has been practically eliminated. In a comparatively short time the savings effected have paid for the new equipment. Similar results are possible in many other shops in which tools and equipment have been antiquated by years of service. Each machine tool or piece of shop equipment that has been in service, say ten years or more may well be subjected to a careful study to determine its unit production costs. After such data have been carefully compiled, why not compare it with similar data for modern equipment of the same type or possibly of another type better adapted for the work? Equipment builders are usually willing to furnish complete data as to the possibilities of their equipment to handle specific jobs. When such data are compared with present shop costs many opportunities for highly profitable investments are likely to be disclosed.

The why of freight car inspection

The proper inspection of freight train cars is absolutely essential to successful railroad operation and too much cannot be said of the importance of the car inspector's work and the responsibility resting on supervisors to see that inspectors are properly trained, organized and their work checked. Some significant comments regarding this subject are made by E. E. Roberts, car foreman of the Kansas City Southern, De Queen, Ark., in the March Mechanical Department Bulletin, published by that road. Mr. Roberts lists the principal defects for which inspectors must be on the lookout, such as general condition of car, safety appliance attachments, condition of lubrication features, brake rigging defects, condition of wheels, condition of trucks, missing nuts from column bolts, box bolts and carry iron bolts, operation of air brakes, and loading rule requirements on open top cars. He also says, "The expense involved in cutting cars out of trains, switching same to the repair track, holding them for repairs, delaying the shipment and replacing the cars in the train, is far greater than is generally thought. This action should only be resorted to when circumstances compel it. Safety of both life and property are the principal elements to be considered, and when the condition of the car is likely to involve either, it should be removed from service and have the necessary repairs made to restore the car to serviceable condition."

The American Railway Association code of interchange rules is the car inspector's bible and he can learn much by reading it and studying the changes made effective at the beginning of each year. In addition, the proceedings of carmen's organizations, such as the Railway Car Department Officers Association (formerly the Chief Interchange Car Inspectors' and Car Foremen's Association), the Car Foremen's Association of Chicago and similar associations in other parts of the country afford a great amount of information regarding inter-

change rules both when published in the individual association proceedings and when abstracted in the *Railway Mechanical Engineer*. Arbitration decisions of interest also are given in each issue of this publication.

Perhaps the best opportunity for self-education of car inspectors along these lines, however, is by personal attendance and participation in association meetings devoted to the discussion of interchange rules. When a man tries to study important changes in the rules by himself, it is more difficult to grasp what they mean to his railroad or car line and their effect on his everyday practices, than if he has a chance to read and discuss them with other practical men like himself. No opportunity should be overlooked for carmen to get together and calmly, deliberately and critically analyze the various important problems involved in the interchange of railway freight train cars.

Two noteworthy conventions

Programs for two conventions are published elsewhere in this issue, both of which merit the attention of mechanical department officers. The program of the International Railway Fuel Association convention, to be held at Chicago, May 10 and 13, inclusive, carries out the standard of service which this organization has gradually developed for itself. This is the one association which brings together on a common ground executive, purchasing, operating and mechanical officers and employees, and in bringing these groups together for the discussion of the wide range of problems pertaining to fuel economy, it has done much to develop a vision of railroading as something broader than departmental activities. Motive power department officers of all ranks will find much of value at the coming convention. The other program is that of the Mechanical Division meeting to be held at Montreal, Quebec, June 7 to 10, inclusive. It is an interesting coincidence that the meeting of this organization, which marks the sixtieth anniversary of the organization of the Master Car Builders' Association, the older of the two voluntary association now united in the Mechanical Division, should be held at Montreal during the season when Canada will celebrate the sixtieth anniversary of the organization of its dominion government. It is the program itself, however, which deserves comment. Not only will the members discuss the usual reports of the standing committees, but in the form of individual papers and addresses, they will consider a larger number of new and broad problems than have been brought before them at any recent meeting of the Mechanical Division. Although this year's meeting will be unaccompanied by an exhibit of the Railway Supply Manufacturers' Association, the character of the program justifies a full attendance of the members.

Uniform spindle ends for milling machines

In the New Devices pages of this issue is a description of the standard spindle and adopted for milling machines from two horsepower to twenty-five horsepower capacity developed by nine manufacturers, members of the National Machine Tool Builders' Association. This piece of work is worthy of the highest commendation and marks the completion of one part of a general plan for the standardization of machine elements. It typifies the constructive activities of which organizations such as the National Machine Tool Builders' Association are capable and indicates that further progress in the same direction may be expected from the machine tool builders. The committee of engineers of the milling machine group is primarily responsible for this accomplishment.

One of the first questions that will arise in the minds of milling machine users will be as to the extent to which the new standard spindle end will make obsolete milling machines already in service. The user will also want to know what provision has been made for using existing auxiliary equipment with the new type of spindle. The answer to these questions is that fifteen arbors, adopted as standard for use with the new spindle, take the place of approximately 250 existing sizes of arbors, thus ultimately making possible a big reduction in the investment in auxiliary equipment, that designs for adapters have already been worked out to permit the use of existing arbors, and that with the new type of spindle sticking of the arbor is impossible. Another point in favor of the milling machine user is the economy of the complete interchangeability of all arbors and face milling cutters of any size or make of milling machine within the capacity range covered. There is no question but that the adoption of this standard spindle end will be of economic benefit both to the milling machine builder and the user.

Books for apprentices

A superintendent of motive power recently asked the apprentice instructors on his road to have each apprentice answer in writing the following questions: "(1) Do you read systematically a certain amount of time each week; if not, do you read to any extent? (2) What is the nature of your reading—newspapers, magazines, technical papers, etc.? (3) What benefits do you derive from the apprentice course? (4) How may the apprentice course be improved? In shop work? In the apprentice school?"

In some form or other in almost every answer to the fourth question a reference library for the apprentice was suggested. One apprentice said, "The best improvement in the apprentice school would be the addition of a library of mechanical books which we could draw out and take home to study. Valve books especially are needed." Another apprentice said, "Would recommend that a suitable library be installed for the apprentices, being composed of books on general machine work, general locomotive work, boiler work, molding, patternmaking, etc. This would give an apprentice an opportunity to combine his practical and technical knowledge which he may derive from the books." A third said, "It seems that the school should be better equipped in the way of references. A fellow doesn't have a chance of learning the ins-and-outs of everything in the shop and if there was a library or so many books on locomotives, which he could take home and wise himself up in his spare time, he would learn a lot more in his trade and be better prepared to go about things and to understand the subject of locomotives."

As a result of this inquiry it was decided to establish a library for the apprentices at one of the larger shops. The problem, however, is to select the best books for such a library and to devise ways and means of having the apprentices make the greatest and best use of them. The superintendent of motive power has asked us for recommendations as to the books to be purchased. We should like to have the help of our readers in preparing a suitable reply. What book or books has your practical experience indicated to be of special value to the apprentices? How can the best use be made of them? We shall be glad to hear from the apprentices themselves, as well as from mechanics, foremen and supervisors.

One job where you can't "pass the buck"

At a recent railroad club meeting some one was heard to remark that "all the 'buck passing' was not done in the army." Evidently the speaker seemed to think that considerable "passing of the buck" was being done by railroad officers as well as by generals. Instances have been revealed where some master mechanics seem to think it to be their duty to do as little work as possible on locomotives that come into their terminals from neighboring divisions. Of course, the object is to make a good showing at the expense of one's neighbor. It does not require extraordinary intelligence to know that it is impossible to operate a railroad efficiently where such a condition exists.

There are certain to be times when locomotives are run into neighboring division terminals that considerable work must necessarily be performed outside of the home shops, and the master mechanic of the home shops is dependent to a great extent on help from his neighboring master mechanic. There are also many instances, where the operation of adjoining divisions interlock, that the locomotive is run into another terminal, stays only a few hours and is out on the road again; there are other instances where a locomotive is assigned to one master mechanic and operates almost the entire time out of a terminal under the supervision of another master mechanic.

Misunderstandings or "passing the buck" as to the amount of work the neighboring shops ought to do on a locomotive will not result in efficient locomotive operation. Misunderstandings can be easily cleared up by frequent visits of neighboring master mechanics to each other's shops. "Passing the buck," however, is a more serious evil and is in some cases, harder to rectify. If a master mechanic cannot be made to understand that the economies effected by one master mechanic at the expense of another usually cost the railroad more than if the repairs had been properly made in the first place, or that a make-shift repair job must sooner or later be done right at additional expense, he should be assigned to duties, in the performance of which voluntary co-operation is not required.

More attention to oil burners

Some interesting figures, issued by the Bureau of Railway Economics, Washington, D. C., show that class I railroads in the United States, as of December 31, 1925, had a total of 7,112 oil-burning locomotives available for service. Twenty-four railroads in the Southwestern region operate oil-burning equipment, but individual railroads having the largest number of oil burners in service are in the Central Western region, where the Southern Pacific is credited with 1,610 and the Atchison, Topeka & Santa Fe with 984. On the eastern seaboard, the Florida East Coast, with 207 locomotives equipped, is the only road operating any considerable number of oil burners. A single railroad in the New England region, the New York, New Haven & Hartford, reports one oil burner.

While oil-burning locomotives on American railroads represent but a comparatively small proportion of the total motive power, the fact remains that 51 Class I carriers operate more or less of this equipment which, in many instances, is receiving less than its due share of attention at the various club meetings, conventions and gatherings of railroad mechanical men. At the annual meetings of the Mechanical Division, the International Railway Fuel Association and the Traveling Engineers' Association, for example, the greatest emphasis is rightfully placed on coal-burning equipment, but that does not mean that the possibilities of economy by improved oil-burning practices should be overlooked. The records indicate that, in general, railroad mechanical associations may well give more attention than in the past to a consideration of oil-burning locomotives, their equipment and operation.

An example of what can be accomplished with modern steam locomotives equipped to burn fuel oil is afforded by the performance of the new Texas type power on the Texas & Pacific. According to a recent report in the T. & P. Association News, one of these locomotives burned only 900 gal. of oil on a 140-mile run from Baird, Texas, to Ft. Worth, with a fruit train of 40 loads and 31 empties, or 2,761 adjusted tons. One stop was made to meet another train and to take water at Mingus, and the total road time was 5 hr. and 15 min. The unit fuel consumption was 2.5 gal. per 1,000 gross ton-miles. The average performances of Texas type locomotive over a 10-month period on this same run, having maximum grades of 1.4 per cent, was a fuel consumption of 1,826 gal. of oil per trip, handling an average of 2,686 adjusted tons and burning 4.9 gal. of oil per 1,000 gross ton-miles.

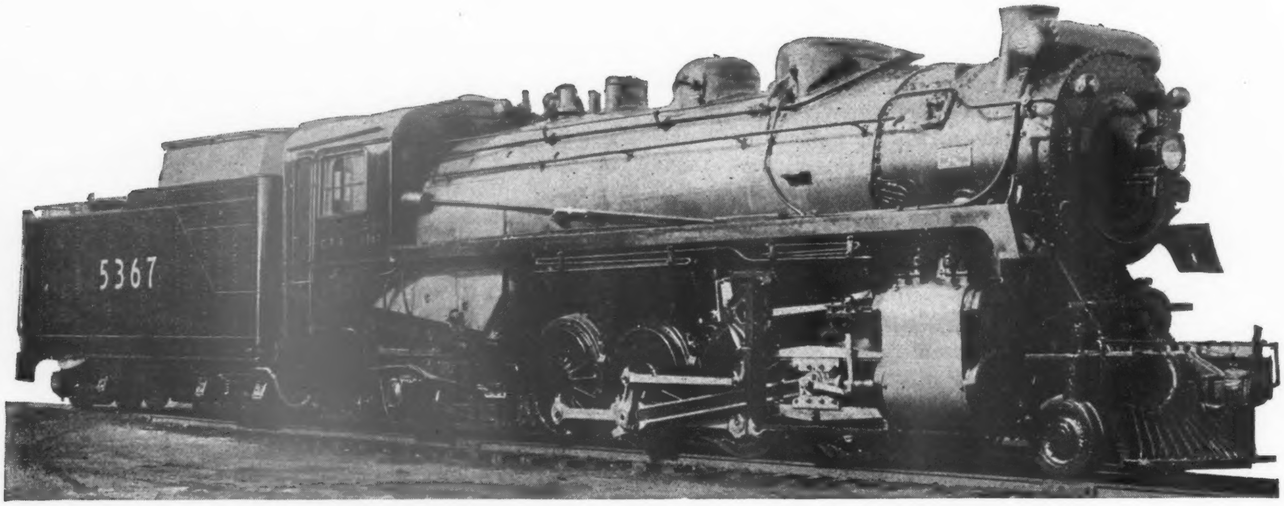
New Books

Instruction Manual, Arc-Welding. *Published by the Lincoln Electric Company, Cleveland, Ohio. Bound in paper, 5 in. by 7½ in., 92 illustrated pages. Price $1.00 per single copy.*

The Instruction Manual for electric arc welding is revised annually to cover the latest practices and is of interest to practically every one who employs the arc welding process. Among the subjects treated are: High-speed steel welding; high pressure pipe welding; automobile frames; boiler repairs; welding cast iron; manganese steel welding; carbon arc welding and the manufacture of machinery and equipment, using welded steel in place of castings. This manual is intended for the use and information of the electric welder and contains much information of value in railroad shop work.

Tool Foremen's Proceedings. *Compiled and edited by G. G. Macina, secretary-treasurer, 11402 Calumet Avenue, Chicago. Imitation leather, semi-flexible binding. 176 pages, 5-in. by 9-in., illustrated, price $2.50 per single copy.*

This book contains a detailed report of the fourteenth annual convention of the American Railway Tool Foremen's Association held at Chicago, September 1, 2, and 3, 1926. In addition to a number of important addresses bearing on the tool foreman's work the book contains committee reports presented at the last annual meeting together with the subsequent discussion. Drawings are included of the recommended standard boiler taps, the adoption of which constituted one of the most important works ever undertaken by the association. The illuminating discussion of the Standardization Committee's report alone makes the 1926 proceedings well worth study, not to mention the numerous illustrated descriptions of air brake and locomotive shop kinks and devices. The book is well arranged and indexed for convenient reference.



One of the Mikado type locomotives built for the Canadian Pacific by the Canadian Locomo tive Company

Locomotive boilers with nickel steel shells

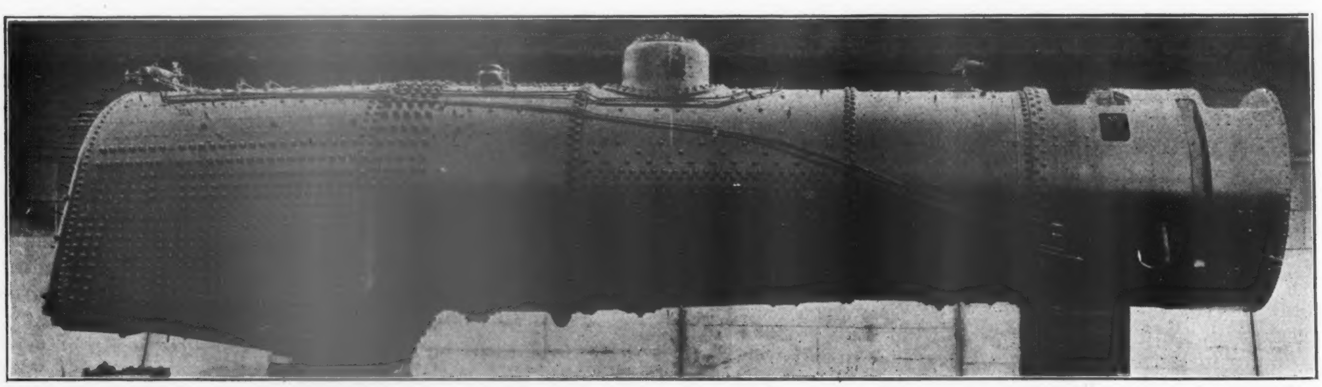
Permits 25 per cent increase in pressure on Canadian Pacific's new 4-6-2 and 4-8-2 types

PACIFIC and Mikado type locomotives of 42,600 lb. and 56,300 lb. tractive force, respectively, have been the standard heavy passenger and general freight service locomotives on the Canadian Pacific for the past eight years. These locomotives were designed in 1919 by the mechanical staff of the Canadian Pacific as the largest locomotives of their respective types that could be generally used for main line traffic. There was nothing unusual about these locomotives; they were well proportioned power operating at 200 lb. boiler pressure. When the question of additional power was being considered in 1926, it was decided that in general these two classes of locomotives should be perpetuated with the exception that such improvements in capacity and efficiency would be made as was possible without increasing the weight beyond a rather narrow range. What was accomplished in this respect is illustrated in the following table which gives a comparison of the principal weights, dimensions and proportions of the earlier locomotives and the new designs:

Comparison of principal proportions of the former Pacific and Mikado designs with those of the new locomotives

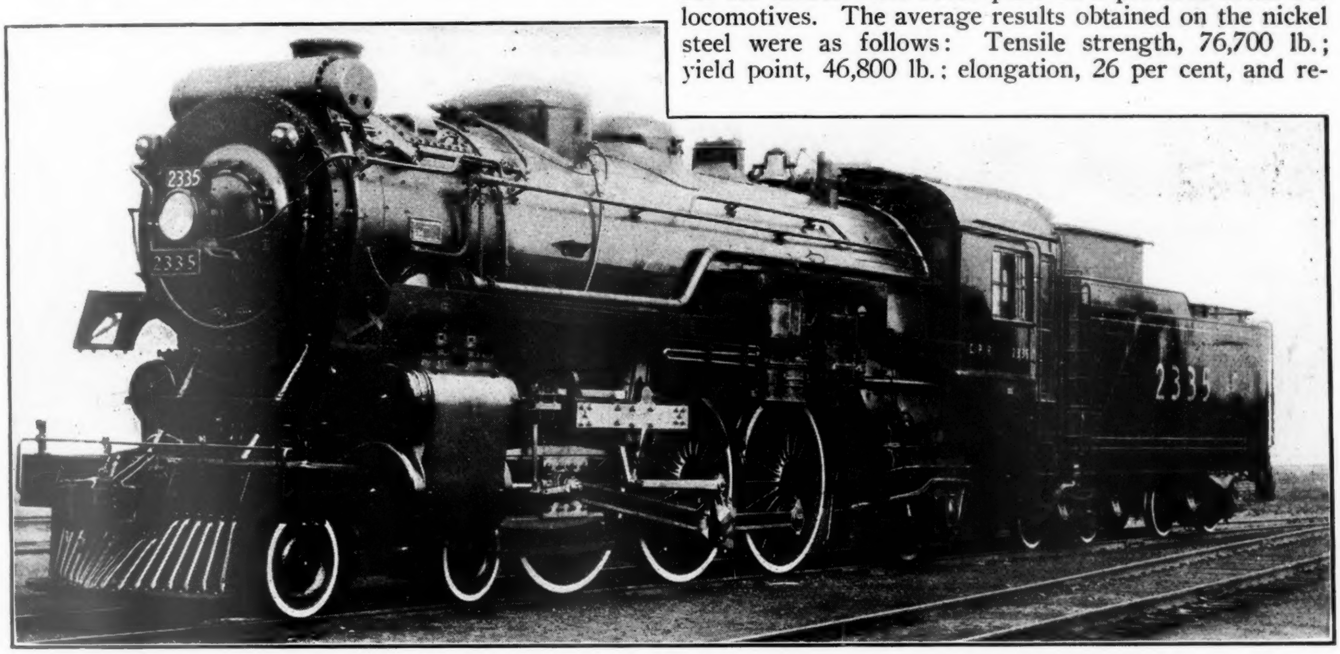
	Pacifics		Mikados	
	New	Former	New	Former
Tractive force, lb.	45,000	42,600	57,100	56,300
Cylinder horsepower (Cole)	2,379	2,252	2,379	2,342
Cylinders, diameter and stroke	23x30	25x30	23x32	25½x32
Diameter of drivers, in.	75	75	63	63
Weight on drivers, lb.	184,300	179,300	244,600	240,100
Total weight of engine, lb.	306,500	300,500	335,200	321,800
Boiler pressure, lb. per sq. in.	250	200	250	200
Grate area, sq. ft.	65	65	70.3	70.2
Total evap. heating surface, sq. ft.	3,272	3,530	3,436	3,562
Total superheating surface, sq. ft.	864	803	970	973
Comb. evap. and superheating, sq. ft.	4,136	4,333	4,406	4,535
Weight on drivers ÷ tractive force	4.08	4.22	4.2	4.27
Total weight engine ÷ total heating surface	74	69.3	76	71.2
Tractive force ÷ comb. heat surface	10.9	9.78	12.95	12.38
Firebox heat. surf., per cent of evap. heat. surface	8.9	8.44	9.0	8.59

Modifications eventually decided on included an increase in boiler pressure of 25 per cent or up to 250 lb. pressure per sq. in., the use of feedwater heaters, the use of front end throttles and the operation of auxiliaries by superheated steam. The application of the Elesco



Boiler with nickel steel shell for one of the Pacific type locomotives

closed type of feedwater heater with a C-F1 class duplex pump, accounted for the increase in weight of 6,000 lb. To increase the boiler pressure 25 per cent and at the same time to keep within a total locomotive weight increase of two per cent would, on the face of it, appear an impossibility. But in doing this, the Canadian Pacific put into effect a step in locomotive construction that it has been investigating and considering for a considerable length of time. This was the use of nickel steel boiler plate of 70,000 lb. per sq. in., minimum tensile strength, which permitted on the two designs of locomotives under discussion an increase in boiler pressure up to 250 lb. per sq. in. without any change in the thickness of the barrel course plates. Altogether, 44 locomotives were constructed in 1926, 24 Pacific type locomotives being built by the Montreal Locomotive Works, Montreal, Que., and 20 Mikado type constructed by the Canadian Locomotive Company, Kingston, Ont. All 44 were delivered during August, September and October, 1926, and they have fully justified the expectations of improved performance and efficiency due to the higher boiler pressure and other improvements in design.



Canadian Pacific 4-6-2 type locomotive built by the Montreal Locomotive Works

Boiler of nickel steel permits increase in pressure

The boiler has been changed very little over the base design for 200 lb. pressure. It is of the radial stay type and beyond the thickening of the wrapper sheet and firebox side sheets and a careful investigation and checking of all details of construction, there are practically no changes made other than the substitution of nickel steel boiler plate for carbon steel in the first, second and third course sheets and welt sheets and the use of steel for longitudinal braces of the boiler.

The nickel steel boiler plate is open hearth basic steel made and rolled by the Lukens Steel Company with the joint inspection and co-operation of the American Locomotive Company, the International Nickel Company and the Canadian Pacific. It was anticipated that the plates would have a somewhat pitted surface typical of nickel steel but the surface conditions were quite equal to carbon steel boiler plate. The physical and chemical requirements for the nickel steel, called for on the railway company's specifications, as compared with carbon steel, are as follows:

	Carbon steel	Nickel steel
Carbon	Not specified	.20 max.
Manganese	0.3 to 0.6	.4 to .8
Phosphorus	.04 max.	.045 max.
Sulphur	.05 max.	.045 max.
Nickel	....	2.75 to 3.25
Tensile strength	55,000 to 65,000 lb.	70,000 lb. minimum
Yield point (minimum in lb. per sq. in.)	50 per cent of tensile strength	50 per cent of tensile strength
Elongation in 8 in. (minimum per cent)	1,500,000 ÷ tensile strength	1,600,000 ÷ tensile strength (with 20 per cent fixed minimum)
Reduction of area (minimum)	Not specified	50 per cent

It will be noted from the specifications that this material will effect a saving of 27 per cent in the weight of the barrel course sheets, or permit the use of higher pressure without a corresponding weight increase.

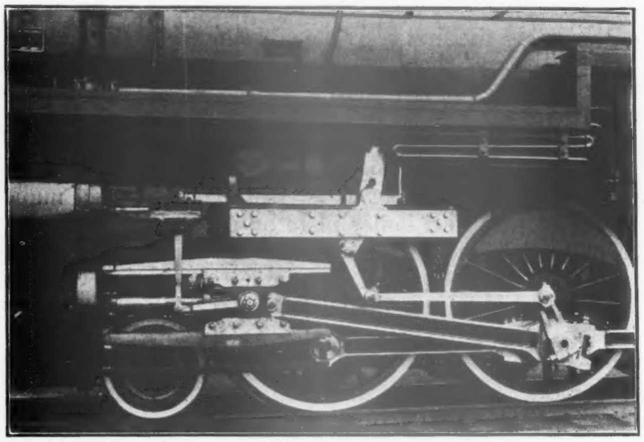
This being the first alloy steel produced by the Lukens Steel Company, there was some preliminary work and investigation required before the material was finally produced on a commercial basis, but once started, very uniform material was produced. To illustrate, an analysis was made of the physical properties of 465 determinations of nickel steel boiler plate and an equal number for carbon steel boiler plate on a previous order for locomotives. The average results obtained on the nickel steel were as follows: Tensile strength, 76,700 lb.; yield point, 46,800 lb.; elongation, 26 per cent, and reduction of area, 53 per cent. The average tensile strength and yield point for carbon steel boiler plate ran 59,200 lb. and 36,200 lb., respectively, so that the gain in strength based on average results is 29 per cent on both the ultimate strength and yield point basis.

The maximum variation in the various physical properties above and below the average were found to be almost identical for the nickel steel and for an equal number of carbon steel determinations.

The nickel material is remarkably tough and ductile and generally speaking, in the transverse bend tests, the heaviest plate can be bent flat on itself without fracture. Specification requirements call for bending of the plate around a pin, the diameter of which is equal to a certain percentage of the plate thickness, this being worked on a sliding scale based on the usual practice for carbon steel. As nickel steel stood this test readily, the tests were usually carried further until the plate would bend flat on itself and the illustration shows a typical specimen which illustrates the ductility of the material and its ability to withstand the transverse bend tests. From the shop viewpoint, there is little if any difference between nickel and carbon steel from the standpoint of

The design of brick arch used in both the passenger

and freight power is shown in one of the drawings. It will be noted that the design is rather unusual in a firebox of the width shown as there are only four tubes used, the two center tubes being spaced 27 inches apart. This design was adopted after a study was made of the numerous instances of cracking at the throat sheet around the central arch tube on five tube installations, tests showing that with hand firing in particular, the opening and closing of the fire door caused a distinct breathing action due to the expansion and contraction of the center arch tube. The respacing of the tubes has greatly improved this

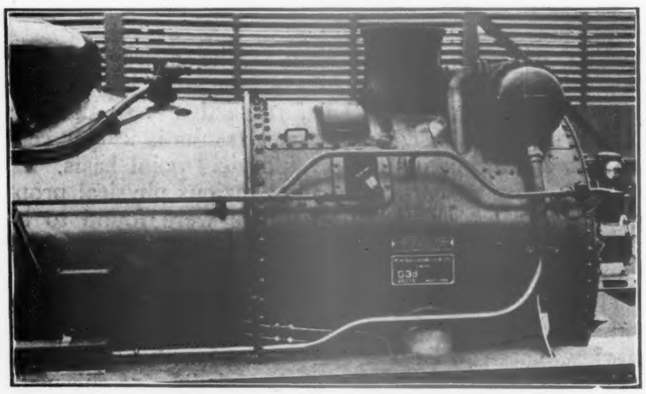


Motion work of the Pacific type locomotive

condition. It is also felt that the center bricks coming together at an angle has helped to concentrate the flame toward the center of the arch to the benefit of the side sheet conditions.

The frames

The frames of the Mikado type locomotives are of carbon vanadium steel and the frames of the Pacific type locomotives are of carbo-vanadium steel on half the order and nickel steel on the balance of the locomotives. The Canadian Pacific has been using vanadium steel frames for 15 years and for the past four years has been purchasing alloy frames to very severe specification requirements. Eight test coupons are cast on selected locations on each frame and six coupons are pulled for each indi-



Arrangement of the feed water heater, and the outside throttle connection—The throttle rod passes through the hand rail

vidual frame, the remaining two being left on for additional annealing treatment if required. The frames are required to be of reasonably uniform hardness and the range in hardness permitted is specified on the Brinell system. Exceptionally good results have been obtained for a number of years from the use of alloy steels for locomotive frames.

The following shows the average physical results obtained from both the vanadium and steel frames:

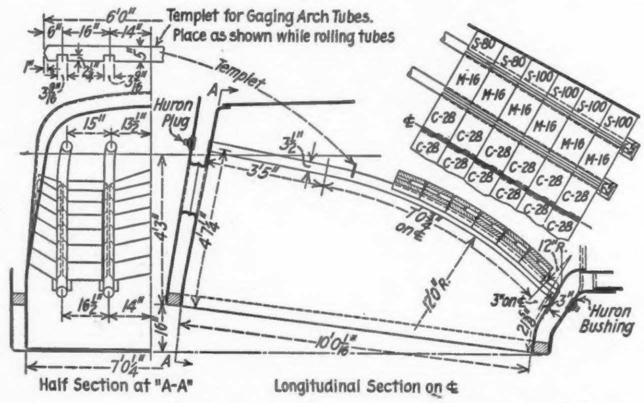
Average physical properties	Vanadium steel	Nickel steel
Tensile strength	87,590 lb. per sq. in.	79,472 lb. per sq. in.
Yield point	49,442 lb. per sq. in.	48,472 lb. per sq. in.
Elongation	28.5 per cent	30.4 per cent
Reduction of area	53.6 per cent	55.8 per cent

A typical analysis of the chemical composition of the two materials is given in the following table:

Average chemical composition; per cent	Vanadium steel	Nickel steel
Carbon	.35	.17
Manganese	.94	.8
Phosphorus	.016	.014
Sulphur	.029	.029
Silicon	.35	.35
Vanadium	.19	....
Nickel	....	2.8

Alloy steel in the running gear

There was a particular incentive in increasing the efficiency and capacity of the Pacific type locomotives as this class of power handles very heavy trains on severe schedules at high speeds. More than the usual care was, therefore, paid to the design of the reciprocating parts, not only to reduce the weight, but to use the highest grade of steel obtainable. Alloy steel has been used for main and side rods on both freight and passenger power for a considerable number of years past and this practice was continued with both classes of power, the Pacific type locomotives being equipped with carbon-vanadium rods and the freight power with nickel-steel rods. This was the Canadian Pacific's first experience with nickel steel rods and good results were obtained. The average



Four arch tubes instead of five are used in the firebox

physical characteristics for all rods on both classes of locomotives are as follows:

	Carbo-vanadium	Nickel
Tensile strength	95,004 lb. per sq. in.	104,900 lb. per sq. in.
Yield point	63,357 lb. per sq. in.	66,760 lb. per sq. in.
Elongation	27.7 per cent	25.3 per cent
Reduction of area	54.24 per cent	51.8 per cent

Special equipment

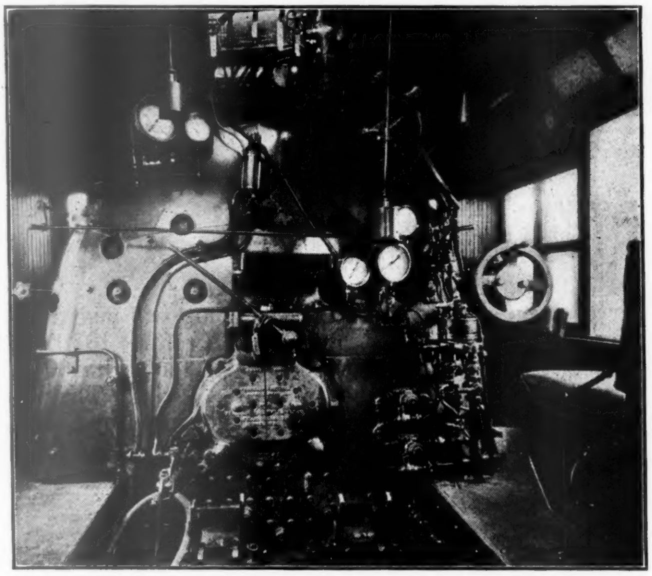
The Elesco Company's type H-5 feedwater heater has been adopted as standard on the new series of locomotives as the result of a good many years' testing of various types of closed heaters. Considerable attention was paid to the mounting of the feedwater heater itself and it was endeavored to arrange the piping as carefully as possible to present the best appearance.

All the new power is equipped with the American multiple throttle with poppet type valves, located in the superheater header. The illustration shows the operation of the car shaft and the supporting of the throttle rod by running it through the hand rail on the right side of the locomotive.

The air compressor, water pump, dynamo, whistle and blower are all operated by superheated steam, the supply of steam being taken from the superheater header to a main control valve located on the left hand side of the smokebox just above the running board, from which the

superheated steam line is brought back and distribution of the steam made from immediately in front of the cab to the various auxiliaries.

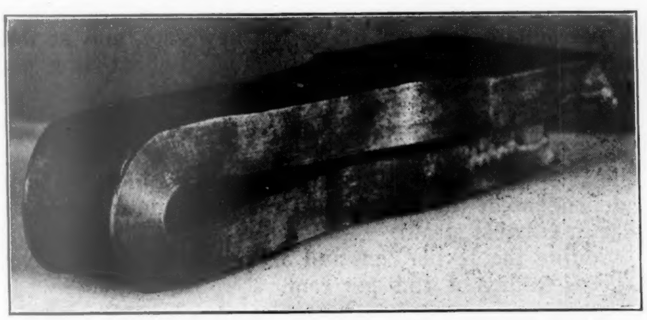
The use of an outside connected throttle has permitted a considerable revision in the cab arrangement as will be seen from the back head view. The water glass is located in the direct center of the boiler, the glass itself being protected by a water glass guard of the railroad company's design which permits ready access to the water gage mountings for changing of water gage glasses. All auxiliary valves have extension handles to one central point in the cab to permit maximum ease of operation. The pressure gages are conveniently located,



Interior view of the cab showing the arrangement of equipment on the back head

as shown in the cab illustration. Five-feed hydrostatic lubricators are used on the Pacific type locomotives and seven-feed lubricators on the Mikado type power, the former locomotives being hand fired and the latter stoker fired by a Duplex type D-1 stoker.

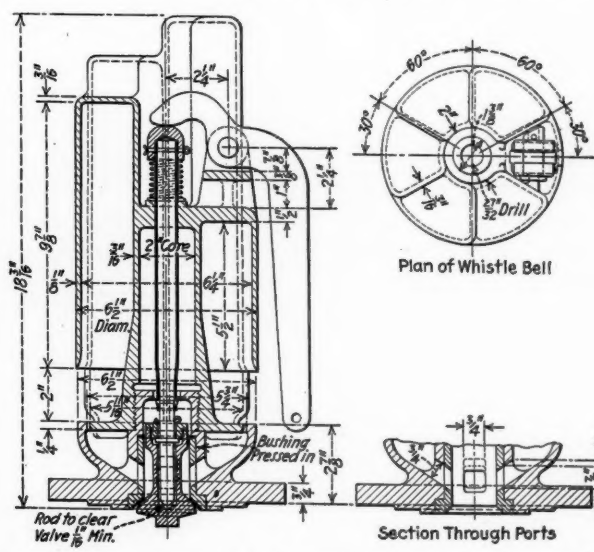
The whistle, the construction of which is shown in one of the drawings, is of a new design and is of rugged and simple construction. The electric classification lamps are of the railroad company's design and are of cast



Test specimen illustrating the ductility of the nickel steel used in the boiler construction

aluminium alloy. The change in color is provided by an inside cylindrical rotating member which carries the glass and is so constructed as to prevent light leakage, which is apt to cause reflections and improper color registration at some angles of vision.

The design of driving and idler boxes, in fact, the majority of the details on the two locomotives are interchangeable. The Pacific type locomotives have Commonwealth Steel Company's one-piece cast steel four-wheel engine trucks, and both classes have cast steel rear frame extensions and cast steel tender underframes. Franklin butterfly type firedoors are used on the Pacific locomotives, and the Franklin clam shell type on the stoker equipped Mikado type locomotives. The reverse



Six-chamber chime whistle used on the new locomotives

gears are of the screw type, of the railroad company design.

The weights, dimensions and proportions of the two classes of locomotives are given in the table.

Table of dimensions, weights and proportions of Canadian Pacific class P-2-E and G-3-D freight and passenger locomotives

Type of locomotive	4-6-2	4-8-2
Railroad classification	G-3-D	P-2-E
Builders	Montreal Locomotive Works	Canadian Locomotive Company
Service	Passenger	Freight
Cylinders, diameter and stroke	23 in. by 30 in.	23 in. by 32 in.
Valve gear, type	Walschaert	Walschaert
Valves, piston type, size	14 in.	14 in.
Maximum travel	7 in.	7 in.
Outside lap	1⅛ in.	1⅛ in.
Exhaust clearance	¼ in.	⅛ in.
Lead in full gear	¼ in.	3/16 in.
Weights in working order:		
On drivers	184,300 lb.	244,600 lb.
On front truck	62,000 lb.	30,600 lb.
On trailing truck	60,200 lb.	60,000 lb.
Total engine	306,500 lb.	335,200 lb.
Total tender	192,260 lb.	229,500 lb.
Total engine and tender	498,760 lb.	564,700 lb.
Wheel bases:		
Driving	13 ft. 2 in.	16 ft. 6 in.
Rigid	13 ft. 2 in.	16 ft. 6 in.
Total engine	35 ft. 0 in.	35 ft. 8 in.
Total engine and tender	67 ft. 10 in.	72 ft. 1½ in.
Wheels, diameter outside tires:		
Driving	75 in.	63 in.
Front truck	33 in.	31 in.
Trailing truck	45 in.	45 in.
Journals, diameter and length:		
Driving, main	12 in. by 14 in.	12 in. by 14 in.
Driving, others	10½ in. by 14 in.	10½ in. by 14 in.
Front truck	6½ in. by 13 in.	6½ in. by 13 in.
Trailing truck	9 in. by 14 in.	9 in. by 14 in.
Boiler:		
Type	Straight top—extended wagon bottom	Straight top-extended wagon bottom
Steam pressure	250 lb.	250 lb.
Fuel	Bituminous	Bituminous
Diameter, third ring, outside	88 in.	90 in.
Firebox, length and width	111 1/16 in. by 84¼ in.	120 1/16 in. by 84¼ in.
Arch tubes, number and diameter	4—3½ in.	4—3½ in.
Combustion chamber length	26 in.	26 in.
Tubes, number and diameter	28—2 in. and 160—2¼ in.	32—2 in. and 158 2¼ in.
Flues, number and diameter	40—5½ in.	45—5½ in.
Length over tube sheets	18 ft.	18 ft.
Grate area	65 sq. ft.	70.3 sq. ft.
Heating surfaces:		
Firebox and comb. chamber	258 sq. ft.	274 sq. ft.
Arch tubes	33 sq. ft.	36 sq. ft.
Tubes	1,950 sq. ft.	1,966 sq. ft.
Flues	1,031 sq. ft.	1,160 sq. ft.
Total evaporative	3,272 sq. ft.	3,436 sq. ft.
Superheating	864 sq. ft.	970 sq. ft.
Comb. evaporative and superheating	4,136 sq. ft.	4,406 sq. ft.

Tender:		
Style	Rect. water bottom	Rect. water bottom
Water capacity	8,000 Imp. gal. (9,600 U. S. gal.)	10,000 Imp. gal. (12,000 U. S. gal.)
Fuel capacity	12 ton	16 ton
Wheels, diameter	36 in.	36 in.
Journals, diameter and length	6 in. by 11 in.	6½ in. by 12 in.
General data, estimated:		
Rated tractive force, 85 per cent	45,000 lb.	57,100 lb.
Cylinder horsepower (Cole)	2,379	2,379
Speed at 1,000 ft. piston speed (estimated)	44.6 m.p.h.	35.1 m.p.h.

Weight proportions:		
Weight on drivers ÷ total weight engine, per cent	60	73
Weight on drivers ÷ tractive force	4.08	4.2
Total weight engine ÷ cylinder hp.	129	141
Total weight engine ÷ total heating surface	74	76
Boiler proportions:		
Tractive force ÷ comb. heat. surface	10.9	12.95
Tractive force × dia. drivers ÷ comb. heat. surface	816.0	816.5
Cylinder hp. ÷ grate area	36.55	33.8
Firebox heating surface, per cent of evap. heat. surface	8.9	9
Comb. heat. surface ÷ grate area	63.5	62.8

Feedwater heaters on locomotives*

Utilization of benefits should be considered from standpoint of fuel economy and greater earning capacity per locomotive

By V. L. Jones

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APPLICATION of a locomotive appliance carries with it the necessity for a proper balance sheet that will show all costs involved, fixed charges and economies not only directly on the locomotive itself, but also charges or economies arising at terminals, shops and train operation, so that a proper balance may be drawn that will show a net profit of reasonable size after all figures have been considered.

Variable and fixed relations

It is advisable, if possible, to select a typical locomotive on which the boiler and engine relations are known. If no such tests are available, fairly reliable data can be calculated from normal operating figures, locomotive dimensions and test data available throughout the country. Guarantees will be required from the manufacturer of the equipment as to temperatures of feedwater that can be expected with certain exhaust steam pressures and the amount of live steam required by the pump. With this information at hand, the analysis can proceed.

It appears that locomotive performance will be subjected to some change in the following items:

1.—Fuel burned per pound of steam produced.
2.—Amount of superheat.
3.—Overall boiler efficiency.
4.—Back pressure in cylinders.
5.—Overall thermal efficiency.
6.—Tender capacity.

It is thought that time may be saved by following through an example rather than treating and analyzing each factor separately. The following data, which is average, is used as basic information:

Temperature of the water in the tender	60 deg. F
Temperature of the water entering the boiler check	220 deg. F.
Rate of firing (per sq. ft. grate area per hr.) for 100 per cent boiler capacity	90 lb.
Boiler efficiency at above firing rate, per cent	65
Steam required by pump (per cent total evaporation)	2
Boiler pressure	200 lb. gage
Back pressure in cylinders (without heater)	10 lb. gage
Size of tender tank	10,000 gal.

Let us first consider the possible fuel saving. If the water enters the heater at 60 deg. F. and is 220 deg. at the boiler check, approximately 160 heat units have been added to each pound by the exhaust steam. The total amount of heat to change a pound of water at 60 deg. F. into saturated steam at 200 lb. pressure is 1,171 heat units.

However, more steam will now be required as a steam driven pump has been added. The pump will take about two per cent of the boiler capacity. Therefore, 102 lb. of steam will be required from the boiler for each 100 lb. going to the cylinders and all other auxiliaries. The percentage reduction in heat from the fuel caused by adding 160 heat units from exhaust steam and increasing the demand by two per cent is

$$100 - \frac{102\ (1{,}171-160)}{1{,}171} = 12 \text{ per cent.}$$

This is the direct effect of the heater alone, but is not the whole story. The efficiency of a locomotive boiler always increases as the amount of coal fired is decreased. This condition is well understood and while the percentage rate may differ on different boilers, it always increases. Because of this fact a reduction in the amount of coal burned caused by adding heat to the water from exhaust steam will result in an increase in boiler efficiency. This means that a greater proportion of the heat will now go into the boiler and for any selected quantity of steam there will be a further reduction in fuel.

For the locomotive under consideration, a firing rate of 90 lbs. of coal per sq. ft. of grate per hr. has been assumed and at this rate, the boiler efficiency is taken as 65 per cent. Twelve per cent reduction in fuel gives 79 lb. per square foot per hr. as the new rate, and at this rate the boiler efficiency will be increased about three per cent. The reduction in fuel, due to this is

$$79 \text{ lb.} - \frac{79 \times 65}{68} = 3.5 \text{ lb.}$$

This is an additional 3.9 per cent reduction in fuel and is independent of the 12 per cent saving made from waste heat in exhaust steam.

Adding the 12 per cent and 3.9 per cent savings gives a gross saving of 15.9 per cent.

Reduced superheat

The next factor to be considered is the effect on the superheat. As just determined, there is now about 16 per cent less fuel required for evaporation, while the output in pounds of steam per hour has not been decreased. This means that the same quantity of steam is passing through the superheater units but a decreased amount of hot gases is passing around them and therefore we can expect less heat available for the superheater and consequently a lower superheat. However, the lower rate of combustion increases the efficiency of both the boiler and

* Abstract of paper presented at the February 8, 1927, meeting of the New England Railroad Club, Boston, Mass.

superheater, and the reduction to be expected is not in the same ratio as the quantities of steam and gas. An increase from 65 per cent to 68 per cent in boiler efficiency is a gain of 4.6 per cent. Although there are now 83.6 lb. of gases where before there were 100 lb., because of the increased efficiency, 87.3 per cent as much heat will go into the superheater as formerly. Reference to the steam tables shows that this will reduce the superheat from 250 deg. F. to about 218 deg., a reduction of about 32 deg.

At 45 per cent cutoff, steam consumption per indicated horsepower hour will increase about six per cent when the superheat is reduced from 250 to 218 deg. This factor in itself should apparently increase fuel consumption by the same percentage and should apparently tend to offset the 16 per cent gain previously credited. However, before debiting this, consideration must be given to cylinder conditions as affected by back pressure.

Effect on back pressure

A pound of saturated steam at the heater has a volume 1,200 times greater than a pound of water. The heater acts as a condenser with the result that steam is drawn from the cylinders by the heater, condensed therein, and its volume very considerably reduced. This continuous withdrawal of steam from the cylinders, thereby robbing the nozzle of some of its steam, reduces the back pressure.

Calculations of what this may amount to can be made, but would be very difficult and probably not very reliable. Indicator cards carefully taken so that the steam pressure, point of cutoff and speed are the same with and without the feedwater heater in use will give the true facts. Such cards are available. At speeds where the full boiler capacity is employed, it will be found that about six per cent more horsepower is developed at the same point of cutoff with the heater in use.

This value happens to coincide with the per cent increase in weight of steam per horsepower hour, resulting from reduced superheat. Thus six per cent greater weight of steam necessary on account of reduced superheat, balances the increased horsepower from reduced back pressure. Hence the weight of steam per horsepower-hour is not altered by the heater application. Therefore, no further consideration need be given these two features, so far as their effect on the firebox is concerned. However, the increased cylinder horsepower must be considered in a following paragraph with relation to its effect on train operation.

Effect on draft

While there is no exact information available, there is undoubtedly a direct relation between the weight of steam discharged through an exhaust nozzle and the weight of gases discharged through the stack. A good steaming engine gives full boiler pressure at all speeds when the proper cutoff for that speed is used. With a feedwater heater there is about 14 per cent less weight of steam passing through the nozzle but there is about 16 per cent less weight of hot gases to be handled. It seems reasonable to assume, that at least at normal speeds, there should be no difficulty in maintaining a satisfactory vacuum in the smokebox with the same size nozzle, with and without the heater. Experience with a large number of heaters in service throughout the country indicates this to be true.

Thermal efficiency of the locomotive

There will be no real change in the relation of indicated to drawbar horsepower. The weight of steam per indicated horsepower-hour will be the same because of the balancing of the effect of reduced superheat, and reduced back pressure. The heat in each pound of steam, however, will be less because of its lower temperature. This will amount to about 17 B.t.u. per lb. The effect of the heater on the thermal efficiency can be indicated with reasonable accuracy by comparing the pounds of steam produced with and without the heater for a definite amount of heat generated in the firebox.

Taking one million heat units in the fuel in both cases as an example, without a feedwater heater and at an overall boiler efficiency of 65 per cent, then 650,000 heat units appear in the steam. This steam has a temperature of about 640 deg. F. and is formed from water at 60 deg. temperature. There was thus added to each pound of steam about 1,307 heat units. The heat units available would supply 497 lb. of steam at 640 deg. temperature.

When the feedwater heater is applied, the boiler efficiency rises to 68 per cent. Of the one million units supplied, 680,000 units are now used. The steam has a temperature of about 608 deg. F., or 32 deg. lower, and is formed from water entering at 220 deg. temperature. This requires the addition of but 1,130 units per pound instead of 1,307 and the heat available will supply 602 lbs. of steam, instead of 497.

It thus appears that when burning an amount of coal containing one million B.t.u., 497 lbs. of steam at 640 deg. will be delivered without a heater and 602 lbs. at 608 deg. with the heater. This gives 21 per cent more pounds of steam with the heater. As explained previously, the thermal efficiency will vary at the same rate as the weight of steam flow. It would appear from this that an increase in the thermal efficiency of over 20 per cent could be expected.

Tender capacity

It has been shown that 14 per cent of the main engine exhaust is condensed in the heater and returned for boiler feed purposes. With a tender capacity of 10,000 gal., let us assume that the total water evaporated per hour is 5,000 gal. At full capacity, this tender full of water would last two hours on the locomotive without the heater in use.

With the heater in service and with 14 per cent of the main exhaust reclaimed as boiler feed, the balance, or 86 per cent, is drawn from the tender. At this rate, the tender full will last 2.32 hours, or 16 per cent longer.

If the steam exhausted from the locomotive auxiliaries, such as the air pump, feed pump, stoker engine, headlight generator, etc., is carried direct to the feedwater heater, and condensed therein, the 16 per cent increase in tender capacity will rise accordingly, probably on the order of one to two per cent. It is, therefore, apparent, that reclaiming the exhaust steam in the heater as boiler feed is equivalent to a tender of 16 per cent or more greater capacity than without a heater.

Stand-by losses

Up to this point, the calculations are based on the locomotive working at full boiler capacity. Stand-by losses, reduced rates of speed and other such factors concerned with every-day operation, will lower the average boiler performance figure to some extent. It is safe to state that all of these factors combined will, in a great many cases, reduce the total savings by approximately 30 per cent when the average performance of the locomotive over the division is considered, rather than momentary performance at high rates of driving. The 30 per cent figure refers more particularly to freight operation than passenger service, where boilers are worked a greater proportion of the road time at full capacity.

Increased capacity

The purpose of this analysis was to note the effect of

feedwater heater applications on train operation. Obviously this requires consideration of change in locomotive capacity, either in the form of increased speed or increased hauling power. It would appear that an investigation of this feature can best be made on the basis of burning the same amount of coal in a given time for the locomotive with and without the heater.

It has been shown that with due allowances for changes in superheat and back pressure, the weight of steam available for use at the cylinders is a true index of the power available, because, the pounds of steam per indicated horsepower-hour is not changed with the application of the heater.

Therefore, on the basis of again using 1,000,000 heat units in the coal at the same rate in each case, the boiler efficiency will be essentially the same, or 65 per cent. Without the heater, each pound of steam requires the addition of 1,307 heat units per pound, while with the heater, only 1,130 units are required. The increase in weight of steam flow per hour is from 497 to 575 lb., or over 15 per cent. With the increased amount of steam available per hour, the question arises as to what can be expected in the form of increased speed.

Drawbar horsepower varies directly with the speed, and further, there is a constant relation between indicated and drawbar horsepower within range of this discussion so that it is safe to say that a comparison of the indicated horsepower in the two cases will give the answer.

The effect of the heater on back pressure has already been considered with both indicator cards taken at the same speed. However, an increase in speed would increase to some extent the back pressure, and the gain from this feature will be somewhat reduced. Let it be assumed that the increase in speed cuts the 6 per cent gain in half. Consequently, 6 per cent more steam will only produce 3 per cent more work and the pounds of steam per indicated horsepower-hour will now be 3 per cent greater. On this basis, the 575 lb. of steam available must be reduced by 3 per cent resulting in 557 lb., which, referred to the 497 lb. of steam, is a net gain of 12 per cent. Consequently, with an increase in weight of steam flow per hour of 15 per cent, the increase in speed at the same drawbar pull is 12 per cent.

Consideration of a possible increase in drawbar pull can follow the same general line of reasoning as above, namely, on the basis of comparing the indicated horsepower.

For a greater drawbar pull, it is necessary to lengthen the point of cutoff. If indicator cards are available, calculations are easy. If not, comparison of water rates at the two points of cut off will give a reasonably close approximation.

The increased total weight of steam flow with the heater gives steam at a different specific volume than without the heater. The 575 lb. of steam by weight at 608 deg., requires 11 per cent more volume than the 497 lb. of steam by weight at 640 deg. On this basis, the point of cut-off must be increased 11 per cent or, say, from 45 to 50 per cent of the stroke. A comparison of the resulting indicator cards shows an increase in water rate of about 4 per cent. On this basis, the 575 lb. of steam available must be reduced by 4 per cent or to 552 lb., which, referred to the 497 lb. originally available, is an increase of 11 per cent. Consequently, the 15 per cent increase in total available steam can produce 11 per cent greater drawbar pull at the same speed.

Summary

There are two ways of utilizing the benefits of the feed water heater. The first one is to handle the situation entirely from the standpoint of fuel economy. In this case, train loading is kept as before and the direct results are in terms of reduced fuel consumption. The increased tender capacity will take the form of either direct elimination of water stops, or will permit flexibility in selecting the more desirable stops; the increased horsepower should result in slightly faster running time; and the combined result should show reduced fuel and possibly greater ton-miles per train hour.

The other way is to develop greater earning capacity per locomotive with the same amount of fuel as before. The heater application permits development of either increased speed or increased drawbar pull at points where full boiler capacity has otherwise been reached. These factors are directly reflected in increased ton-miles per train hour or, in other words, the ability to handle more business per locomotive.

Guiding into and around curves

A discussion of the guiding qualities of the modern steam locomotive

By J. G. Blunt

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MANY of the practices suitable to earlies types of locomotives become obsolete when considering the large modern locomotive and the following analysis is made with the desire of stating clearly just what takes place with a locomotive entering and passing curves, together with suggestions to increase the efficiency of the locomotive, as well as to lend a greater degree of operating safety. This analysis contemplates the action of locomotives which, for the most part, operate in one direction; double-end operation requires an entirely different analysis.

Various attempts to improve the guiding qualities of the locomotive have long been resorted to, such as setting the tires on different driving wheels with varying distances between them, providing different amounts of hub lateral, using tires without flanges or with flanges of varying thicknesses and contours. While these means have provided a degree of improvement, none of them solve the problem of easily negotiating curves in a manner least destructive to the locomotive mechanism or right-of-way.

All driving wheel tires should be flanged

To obtain the best results, driving tires should all be flanged; wheel hub lateral between the box and the wheel hub should have the minimum practical lateral

allowance with the same amount for each pair of wheels.

Lateral motion devices for driving axles have usually been considered solely from the viewpoint of accommodating the driving wheel base to the maximum required curvature. While this is a necessary requirement, it is only one of the important points to remember when considering the guiding qualities of a locomotive, improvement in its riding qualities and the beneficial effect on the safety and maintenance of its own mechanism as well as of the right-of-way.

Consideration must be given to the locomotive when exerting its maximum tractive force, at the slower speeds, as well as at the higher speeds, also when exerting a small proportion of its power, and with throttle closed and brakes applied.

The difficulty a locomotive encounters in passing curves increases with the degree of curvature, the number of driving wheels, the axle loads, the length of driving wheel base, the speed in miles per hour and the amount of tractive force exerted.

The locomotive, like all other moving bodies, would travel in a straight line unless deflected therefrom by external forces. The driving wheel base, together with the superstructure resting thereon, is difficult to deflect, requiring powerful lateral resistance trucks to impart the necessary deflecting force to the leading driving wheels and superstructure.

Position of drivers when entering a curve

The tendency when entering a curve is for the flanges of the front pair of driving wheels to press hard against the outer rail, the rear drivers bearing against the inner rail, with the flanges of the intermediate drivers free from bearing against either. These conditions vary with the length of the driving wheel base and the degree of curvature. The flange pressure of the guiding truck wheels against the rail must pull the superstructure as well as slide the front drivers across the rail and into the curve; otherwise the rail must absorb the remaining flange resistance of the front pair of driving wheels. It is this deficiency that is so productive of wear at the front driving wheel flanges, as well as to the outer rail on curves. The flange pressure increases until it overcomes the guiding deficiency of the leading truck when a slipping or sliding of the front driver across the rail occurs, carrying with it the superstructure of the locomotive.

In entering a curve, the forward drivers travel in a straight line until these forces and resistances equalize to slide them inward across the rail. Just at this point the most severe wear on flange and rail occurs. The wheel slides across the rail, then runs forward in a straight line until another pinching action occurs, again sliding across the rail, and repeating the action until the curve is passed.

Flange pressure increases as the square of the speed

With a given tractive force, the flange pressure increases as the square of the speed and the degree of curvature to be negotiated. Consequently, at the point when sliding across the rail begins, the tendency of the front driver to mount the rail increases. At slower speeds, when exerting maximum tractive force and just before the sliding of the front driver occurs, the excess stresses set up in the forward section of side rod to overcome this added resistance must be recognized.

The resistance in the truck can be correct for but one condition of curvature, power, speed and wheel base. If made to suit the most severe conditions, excessive wear of truck tires or heating and wear of truck hub surfaces will result. The problem is, therefore, one of selecting a given wheel arrangement to suit the power, speed, track contour, and such other conditions as local requirements demand, then make the best compromise for all these conditions.

Motive power officers are aware that the flanges of the forward pair of driving wheels wear most rapidly and maintenance-of-way officers are also familiar with excessive wear at the inside edge of the outer rail on curves. This rail wear is caused primarily by the front pair of drivers. The long driving wheel base entering a curve may reach a degree of curvature such that the front wheel bears against the outer rail and the next to the last pair bears on the inner rail, at which time excessive tire wear on each is quite sure to follow.

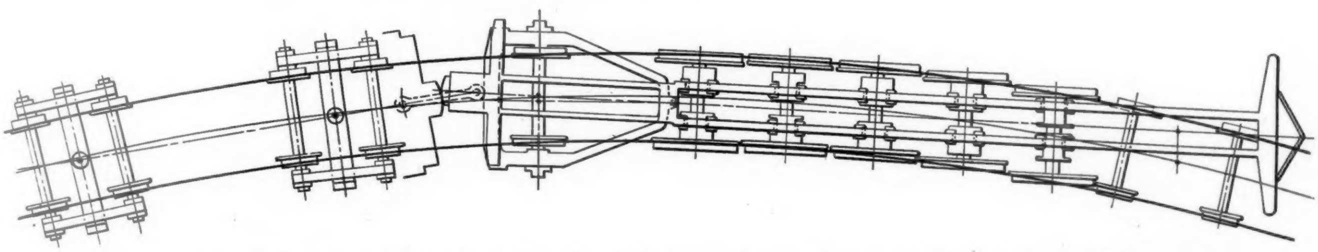
Effect of excessive resistances at the rear end of the locomotive

Excessive resistances at the rear end of the locomotive, such as caused by long overhang, with excessively long fireboxes back of the rear drivers, four-wheel trailer trucks and a spring-compressed buffer face, react disadvantageously on the guiding resistances in the engine truck and front drivers. If the forward resistance devices are not sufficient to overcome the retarding ones at the rear and still provide sufficient excess to deflect the locomotive as a whole, then the leading pair of driving wheels must make up the deficiency. These conditions, unless fully anticipated, will aggravate the wear at the front driving tire flanges, as well as on the outer rail. Insufficient guiding resistance at the leading truck may produce a flange pressure at the front drivers of sufficient intensity to make them mount or push the rail to one side. When any such excessive pressure occurs it reacts with great force on the frame structure at the front pedestal, thus largely explaining the frequency of broken frames at or near this point in the locomotive.

Furthermore, this excessive pressure produces a multitude of severe stresses in the forward driving wheel and axle with the wheel pressed tightly between the rail and the driving box. With larger diameter of drivers and greater speed, these stresses increase.

Resistance to curving by locomotives with four wheel trailers

Let us consider, for example, the 4-6-4, 4-8-4 and



Positions of the wheels relative to the rails, of a 4-10-2 type locomotive and tender when rounding a curve

4-10-4 locomotive types without a yielding resistance at the front driving axle. In this case, the leading truck lateral resistance acts with a moment arm equal to the distance from the truck center pin to the forward driving axle and is opposed by an arm equal to the distance from the trailer truck lateral resistance device (not considering other resistance causes) to the rear driving axle. A long driving wheel base, on relatively sharp curves, may fulcrum about the next to the last driving axle. With a yielding resistance at the front axle, the guiding moment arm of the front truck reaches back to the second driving axle, thereby increasing its guiding effect.

These conditions clearly illustrate why it is of greatest importance to equalize the rail pressure of the second pair of driving wheel flanges with the first, thus dividing the flange and rail pressures, and further helping to guide the locomotive into and through curves. Likewise, the flanges of the two back pairs of drivers on locomotives having five or more pairs of driving wheels should provide a similar equalization of pressure against the inner rail.

To secure this equalization of flange pressure a yielding resistance is required at the driving box for those driving wheel flanges first bearing against the rail at the forward end and, under some conditions, at other points of the driving wheel base. This yielding resistance should increase in intensity with the degree of lateral displacement and provide adjustment for maximum speed requirements such that the leading pair of drivers will be of greatest assistance to the leading truck in guiding the locomotive. The yielding resistance eliminates the shock and softens the blow when entering and passing curves, in turn requiring less lateral resistance in the trailing truck on account of the more gradual adjustment of the wheelbase to the curve.

Flanges should be applied on all driving wheel tires with means provided in the locomotive so that as many of these flanges as possible will come into play in equalizing the flange pressures, thus eliminating excessive wear or fracture of the parts involved.

Much has been said and done toward obtaining adequate and substantial frame bracing and while this should be most carefully looked after, it must be apparent that the frame structure will be greatly relieved in the manner outlined, and at the same time a locomotive will be produced with easier riding qualities, less destructive to itself, and possessing a greater degree of operating safety.

Santa Fe apprentices hold annual meeting

Twenty-nine clubs send delegates to the convention and basket ball tournament

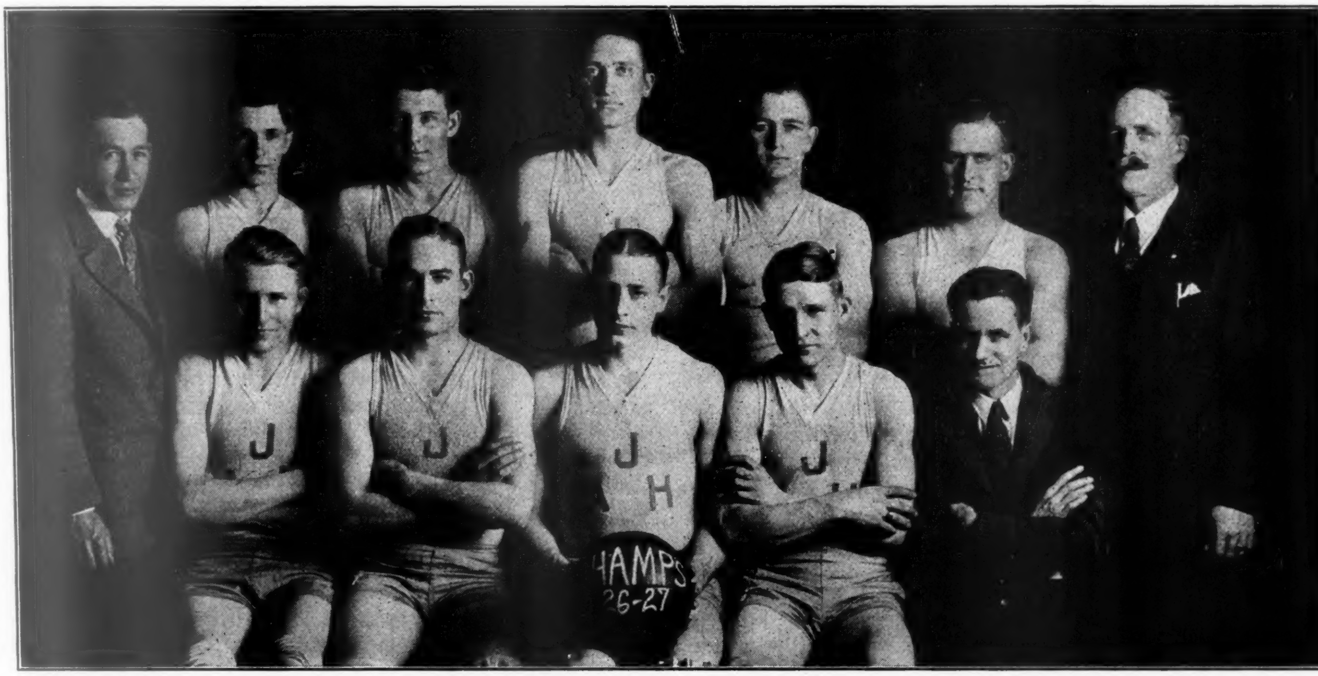
The fourth annual convention of the Santa Fe apprentices and basket ball tournament were held at Wellington, Kansas, February 21-23. Twenty-nine apprentice clubs sent delegates, fifteen of them entering basket ball teams. One-hundred-seventy-eight apprentices registered at the convention; officers of the company and visitors brought the total registration to 241.

The apprentices came from all over the Santa Fe System—from the Mississippi river at Fort Madison, Iowa, to Galveston, on the Gulf of Mexico; from the far off pine groves of Silsbee, Texas, to the orange groves of San Bernardino, California; from Kansas City ("The Heart of America") to Richmond, at the Golden Gate. Boys from Iowa, Kansas, Oklahoma, Texas, Colorado, New Mexico, Arizona and California, all apprentices of the Santa Fe, met for three days, listening attentively to inspiring addresses, and taking active part in the discussion of subjects of direct interest to them in the work of their respective trades, or pertaining to their social or athletic activities. The three-day convention was arranged and conducted by the apprentices, for their own development and entertainment; in the late afternoon and early evening hours they entered into a spirited

Fourth annual convention of the Santa Fe apprentices, Wellington, Kans.

contest in one of the fastest basket ball tournaments ever held.

The convention itself was quite similar to the national conventions of younger railroad men conducted by the Y. M. C. A. in recent years at St. Louis, Detroit, Pittsburgh and Omaha, but with the added feature of the basket ball tournament. Some who have not attended these conventions have gotten the impression that this with a 23-piece band which paraded the town, and played throughout the three days of the convention and tournament. A committee of apprentices investigated and reported to the convention the merits of the two locations. A delegate from each location was given an opportunity to sing the praises of his own city and state. Each responded with no excessive modesty or lack of home pride.



A. J. Hartman apprentice club basket ball team—Winners of the Santa Fe System tournament (with apprentice school instructors, apprentice shop instructor and coach.)

annual apprentice gathering is merely an athletic tournament. This is a mistake, it is both a convention and a tournament; in fact, the boys do not permit an apprentice to enter the tournament unless he attends all the sessions of the convention. An outsider cannot fail to note the intense loyalty of these apprentices to the Santa Fe and its officers, the pride of each shop in its apprentice club, and the hearty co-operation everywhere in evidence.

Each apprentice club is permitted to send four delegates, also a basket ball team; the delegates may or may not be members of the team. The company grants leave of absence and furnishes necessary transportation to the chosen delegates, regardless of their length of service. Officers and other employes and citizens at the place of the meeting take the boys into their homes, giving them bed and breakfast. At least part of the expenses of the delegates to the convention are borne by the local apprentice clubs or by the local shop crafts associations. The local apprentice club handles the details of the convention arrangements, meeting all trains with cars and escorting delegates and visitors to convention headquarters, hotels, etc.

Selecting the place of meeting

Next year the convention will meet at Cleburne, Texas. The different towns on the Santa Fe compete with one another for the honor of being hosts to the boys in these annual conventions. This year the fight centered between Fort Madison, Iowa, and Cleburne, Texas. Both towns came with literature setting forth the advantages of their respective locations. Cleburne came early and strung a big banner across the street in front of the place of meeting. Fort Madison came in a special car

Just prior to the selection of the place of next year's meeting fully 50 telegrams were received from each of these cities—from railroad and city officials, business and professional men and shop craft organizations, etc.—extending a cordial invitation to the boys and urging them to meet with them next year, all of which attested to the high character of the apprentice boys and to the interest taken in them by the officers of the company, by their fellow employes in the shop and by the citizens of the community.

The assembling of these boys in a system convention, giving them an opportunity of seeing other sections of the country, of visiting other shops of the company, of meeting and becoming acquainted with one another and with officials of other shops, of competing in their athletic contests, has done much to create and maintain a friendly feeling of loyalty, and to cement them into one big happy family, desirous of carrying out the aims and policies of the Santa Fe management.

These boys have done much to increase the freight and passenger business on the road, one or two of the clubs carrying out a very effective campaign for shipping by rail. On their athletic trips they refrain from disturbing passengers and give up their seats when necessary. It was noted at the convention that on the morning of the arrival at Wellington of the large delegation from Fort Madison the latter held back and told the manager of the Harvey House to go ahead and take care of the train passengers—they could eat breakfast after the train left. Other delegations performed similar acts of courtesy or thoughtfulness. The boys were full of pep and enthusiasm, but not a single act of rowdyism occurred throughout the tournament, nor en route to or from the convention. On the contrary, the local master mechanic

received many telephone calls from citizens who wished to thank him for the opportunity of entertaining such fine boys in their homes.

The program

T. E. Merryman, machinist apprentice at Wellington, president of the Association of Apprentice Clubs, presided throughout the convention. The meeting opened with prayer and with the singing of America, and with addresses of welcome by Mayor W. P. White, and H. R. Mueller, president of the local Chamber of Commerce. Responses to these addresses of welcome were given by apprentices from apprentice clubs from the following and other division points; Silsbee and Cleburne, Texas; Topeka and Dodge City, Kans.; Waynoka, Okla.; La Junta and Pueblo, Colo.; Albuquerque and Clovis, New Mex.; San Bernardino and Richmond, Cal.; also by Joseph Parrish an apprentice from Albany, New York, who represented the New York Central as a visitor to the convention.

There were also addresses at the opening session by F. W. Thomas, supervisor of apprentices, and W. S. Tasker, master mechanic at Wellington.

At other convention sessions there were addresses by the following officers of the company: A. R. Tellman and Charles Sebrell, safety superintendents, spoke on safety and urged the boys to "think for themselves;" John H. Linn of the apprentice department stressed the importance of loyalty to employer and superior officers, loyalty to friends, and to parents, and to the country in which we live. D. C. Davis, lubrication supervisor, emphasized the importance of proper lubrication and pointed out factors contributing to defective lubrication. E. J. McKernan, supervisor of tools, called attention to the cost of shop tools and to ways in which the apprentices could help reduce these costs. A. H. Bierne, master mechanic, Dodge City; A. J. Hartman, master mechanic, Newton; J. A. Briscoe, division superintendent; A. F. Reeves, assistant supervisor of air brakes; R. J. Gatewood, division engineer, and other officials were in attendance and spoke briefly. The program included a moving picture showing the assembling of Locomotive 3840 at the Baldwin Locomotive Works.

Apprentice year book

The greater portion of the convention was taken up with committee meetings and reports and discussions by the apprentices themselves. L. J. Brasher, machinist apprentice, San Bernardino, editor of the "Iron Horse" an annual, or year book, gotten out by the apprentices themselves, told of the work of getting out the book the past year and made suggestions for next year's publication. This annual, which is similar to that gotten out by high school and college graduating classes, contains photographs of the Santa Fe apprentices graduated last year; also of prominent Santa Fe officials and apprentice club officials, and pictures of familiar scenes along the Santa Fe, of general office and shop buildings, of apprentice athletic teams, etc., together with stories of the activities of the various apprentice clubs during the year, and a report of the last annual convention. It was unanimously voted to get out a similar annual for the year 1927, Apprentice Brasher again being chosen editor.

A considerable portion of one session of the convention was devoted to reports of the various club activities during the past year. These reports proved interesting and helpful, the weaker clubs profiting by the experience and suggestions of the more successful ones. The reports as a whole showed considerable progress. As an evidence of the friendly feeling existing among these apprentice clubs, many of the delegates reported having been met at trains by local clubs and given automobile rides between trains and shown other courtesies enroute to the convention.

Athletic rules

The discussion of apprentice club and athletic rules and financing, led by Apprentice H. K. Ellison, brought out the most lively discussion of all. Each delegate knew what his club had been up against in the past and fought for the rule he felt most just. It was refreshing to note the spirit of fairness shown, the desire of the delegates from the larger shops to give equal opportunity to the boys at points where fewer apprentices were employed, the desire to encourage clean, wholesome sport, but to avoid any tendency to professionalism, and particularly to note the loyalty to the management and the determination to make athletics aid and not interfere with the school and shop work of the apprentices. The athletic rules gotten up and adopted by the boys themselves and submitted to the management for approval stipulate that no apprentice shall be eligible to play on an apprentice team who is behind in his apprentice school work or school attendance, who is reported deficient by the apprentice board in shop work or deportment, who is reported by the apprentice board as permitting athletic activities to interfere with his shop work, or who receives any monetary consideration for playing. It is evident these boys wish to put their athletic activities on a high plane and that they realize these activities should contribute not only to their physical development and recreation but also to their complete, all-around development. Throughout the convention great emphasis was placed on the importance of their being not only first-class mechanics but also men of high character—good citizens as well as good workmen.

R. T. Reeves, boiler maker apprentice, Cleburne, Tex., was elected president for the ensuing year, the grand division vice-presidents being apprentices K. C. Brown, Chanute, Kans.; D. Blair, Pueblo, Colo.; A. C. Bartell, Silsbee, Tex.; and K. D. Mort, San Bernardino, Cal.

Basket ball tournament

Fifteen teams were entered in the basket ball tournament, seven states being represented in the preliminary contests. The teams from Newton, Kans., Wellington, Kans., Pueblo, Colo., and San Bernardino, Cal., went into the semi-finals, the tournament finally being won by the team from the A. J. Hartman Apprentice Club, Newton, Kans. The games were fast, snappy and clean. Among the players were boys who had formerly been stars on high school and college teams; some had played on national championship teams.

In addition to the apprentice band from Port Madison, which played throughout the convention and tournament, the 31-piece shop band from Arkansas City spent one day at the convention, the two bands greatly adding to the life of the gathering. The different clubs had their yells and cheer leaders—derby hats, and canes being in evidence—the enthusiasm reminding one of a college foot ball championship game. The streets of Wellington were bedecked with flags, the windows of the business houses displaying welcome signs, etc.

The Newton Club, which carried off the basket ball championship trophy, has the honor of also winning the base ball and foot ball championships of the apprentice teams of the Santa Fe System during the past year. Just before going into the finals of this basket ball tournament, this team received 15 telegrams from home expressing confidence in them and spurring them on to victory. On their return home a banquet was given in their honor by the local Chamber of Commerce, all of which testifies to the clean sportsmanship of these boys

and to the friendly co-operation between the railroad people and local business men.

Mention should be made also of the noon luncheons during the convention days, where the boys ate together and engaged in lively singing and good natured bantering. F. W. Thomas, supervisor of apprentices, acted as toastmaster at the annual banquet and Fred Voiland, formerly president of the National Retail Clothiers' Association, gave an address on "Salesmanship," dramatically pointing out that individuals, corporations and nations must all sell themselves and have something worth while to sell. At the banquet the state songs of the states were sung and an apprentice from each state told of the superior advantages of the state he represented.

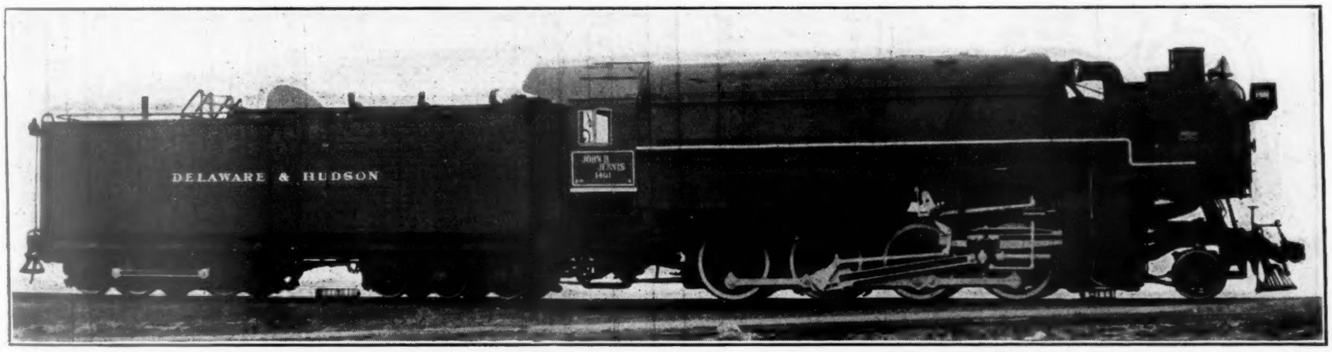
The convention closed with the annual ball. The boys returned to their homes greatly refreshed and inspired, and with a greater pride in their jobs, a greater loyalty for the Santa Fe and its management, and a greater determination to maintain and still further improve the high standard of service rendered by the Santa Fe.

The "John B. Jervis"—A high pressure locomotive

Second D. & H. 2-8-0 cross-compound, with water tube firebox, carries 400 lb. boiler pressure

A CROSS-COMPOUND Consolidation type locomotive, carrying a working boiler pressure of 400 lb., was delivered to the Delaware & Hudson by the American Locomotive Company on February 2, 1927. It has since been operating in freight service between Oneonta, N. Y., and Mechanicsville. This locomotive, which has been named the "John B. Jervis" in honor of the memory of the first chief engineer of the Delaware & Hudson Canal Company, is of essentially the same design as the "Horatio Allen," its predecessor by a little more than two years.

John E. Muhlfeld, consulting engineer for the railroad is responsible for the design of both locomotives. They both have water tube fireboxes of unique construction; both carry much higher boiler pressures than are common locomotive practice, and both have cross-compound cylinders. The boiler pressure of the new locomotive, however, is 50 lb. higher than the 350 lb. of the Horatio Allen, and several changes have been made in the proportions of the firebox. By the elimination of certain auxiliary devices and by refinements of the design in various details, the weight has also been considerably reduced. The appearance of the locomotive has been changed from that of the Horatio Allen by the remodeling of the jacketing.



The "John B. Jervis" develops a maximum tractive force of 103,000 lb.

A comparison of the principal dimensions and proportions of the two locomotives is given in the table. Aside from the points already alluded to, it will be seen that the cylinder diameters are smaller, so that, with the higher boiler pressure, they develop substantially the same tractive force.

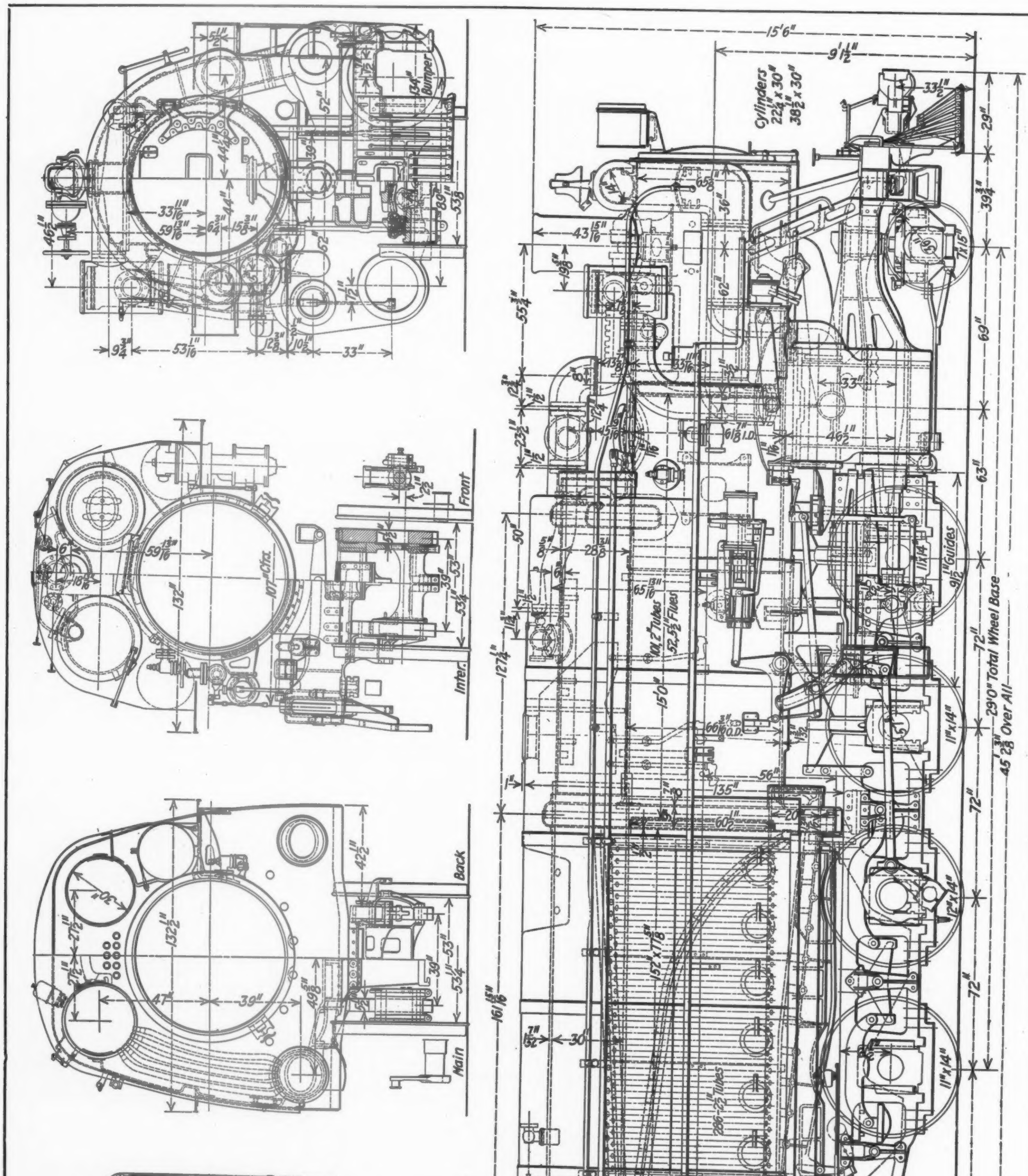
The boiler

The boiler has a water tube firebox and a fire tube barrel, the latter of relatively small diameter and completely filled with water. The steam space is in the steam drums of the firebox which are carried forward well beyond the firebox and connected to the barrel near their front ends.

It will be remembered that the heating surface in this firebox is not entirely of water tubes.* The back head and rear fire tube sheet connections are water leg headers, each built of parallel stayed sheets, through which pass the two 20-in. water drums at the bottom and the two 30-in. steam drums at the top. Ports through the drum shells in the header spaces, provide for circulation between the drums and headers. The front extensions of the steam drums pass through a saddle connection of parallel stayed sheets which is riveted to the boiler shell. Circulation between the barrel and steam drums, through the saddle, takes place through ports in the shells. The barrel shell is riveted into a flanged opening in the front wall of the front water leg and the rear fire tube sheet is riveted into a similar opening in the back wall of this water leg.

The outstanding difference in the boiler of the "John B. Jervis," as compared with that of the Horatio Allen, is an increase of 15 in. in the length of the firebox, and

* For a description of the "Horatio Allen," see the *Railway Mechanical Engineer* for February, 1925, page 79.



Cross sections and elevation of the "John B. Jervis"

an increase of 3 in. in the width of the firebox, the water drums having been spread that much farther apart. This effects the increase in grate area noted in the table.

In the Horatio Allen the heating surfaces of the sides of the firebox were made up of 306 tubes, about two thirds of which were 2 in. in diameter and the remainder 2½ in. in diameter. The ends of these tubes were arranged in six staggered rows where they entered the water and steam drums, the two outside rows on each side, however, really forming one solid row of tubes along the sides of the firebox, against which the lagging

Principal dimensions of the "John B. Jervis" and the "Horatio Allen"

	John B. Jervis	Horatio Allen
Weight on drivers	295,000 lb.	298,500 lb.
Total weight	336,500 lb.	348,000 lb.
Total evaporative heating surface	3,121 sq. ft.	3,200 sq. ft.
Superheating surface	700 sq. ft.	579 sq. ft.
Grate area	82 sq. ft.	71.4 sq. ft.
Cylinders	22¼ in. and 38 in. by 30 in.	23½ in. and 41 in. by 30 in.
Diameter of driving wheels	57 in.	57 in.
Boiler pressure	400 lb.	350 lb.
Cylinder tractive force:		
Compound	70,800 lb.	70,300 lb.
Simple	85,000 lb.	84,300 lb.
Tractive force of auxiliary locomotive	18,000 lb.	18,000 lb.

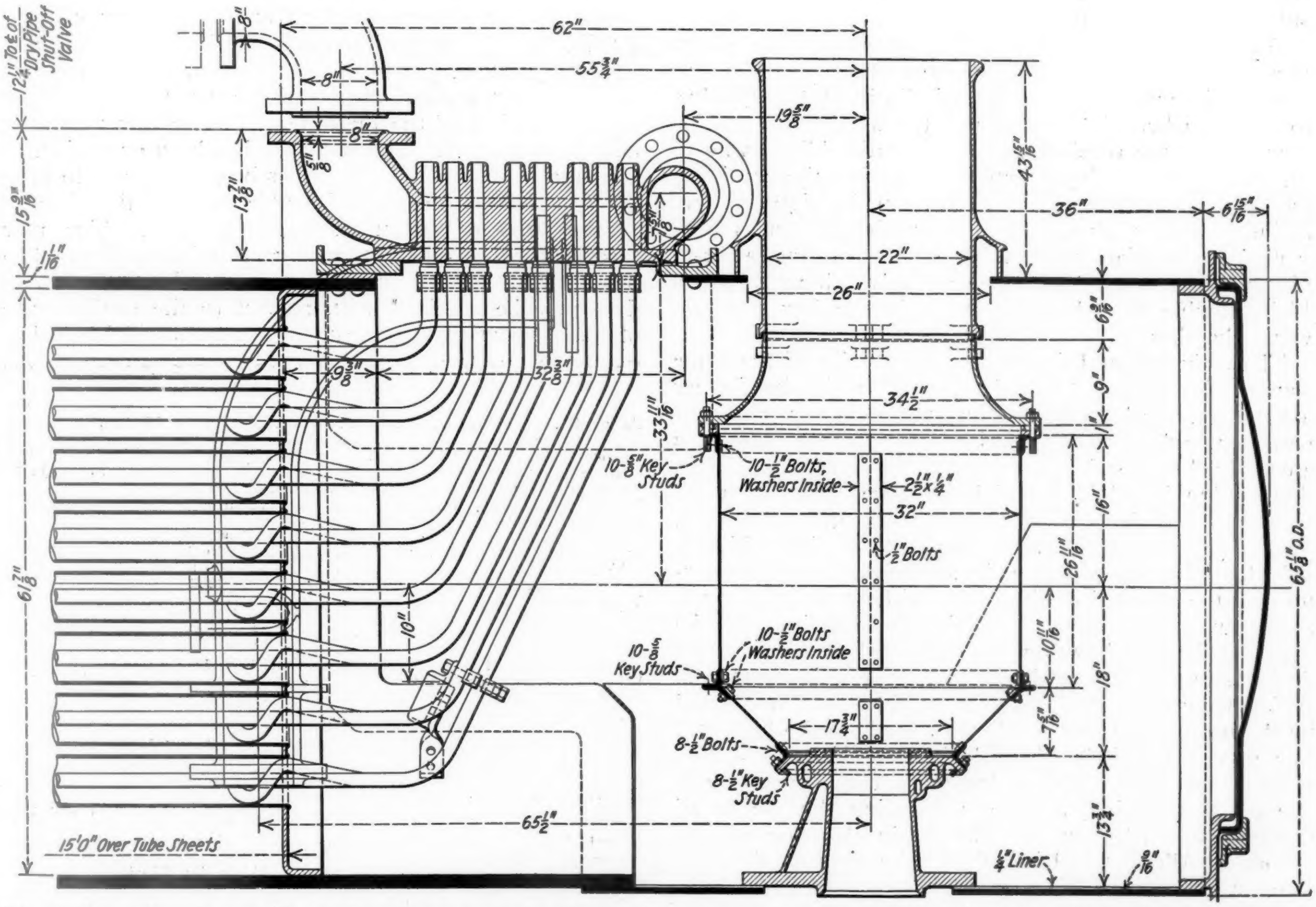
was applied. In the new locomotive there are only 286 tubes, all 2½ in. in diameter, arranged in five rows throughout their length. The sides of the firebox are closed with panels of Ascoloy steel sheets, the ability of which to withstand the high temperatures incidental to contact with the fire has been demonstrated by special tests. The lagging is applied outside of these sheets.

Just above the water drums along each side of the firebox, a number of handhole openings are secured to the firebox wall sheets. These permit cleaning off from the tops of the drums and from the fire tubes of any accumulation of ash which may have been carried over from the grates, without knocking the fire.

While these changes have effected some slight variations in the heating surface distribution in the two locomotives, the only change of moment is the increase in the superheating surface from 579 sq. ft. to 700 sq. ft. Experience with the "Horatio Allen" and other tests have indicated that no difficulty need be anticipated from maximum steam temperatures considerably in excess of 600 deg. F., for which the superheater in the Horatio Allen was originally proportioned. The superheater in the "John B. Jervis" is proportioned to produce a maximum steam temperature of about 700 deg.

The interior firebox arrangement is essentially the same in both locomotives. The brick arch extends the entire length of the firebox and causes the gases to flow outward and up through the five longitudinal staggered rows of water tubes on each side, thence into the combustion space above the arch and to the fire tubes. As in the boiler of the "Horatio Allen," eight longitudinal water tubes are located between the firebox headers at the top of the combustion chamber. The auxiliary superheater, which was located in the firebox of the "Horatio Allen," has been omitted in the new locomotive.

In the "Horatio Allen" four pipe connections were carried up from the top of the boiler barrel and connected alternately to the two steam drums. Considering that with the steam collector arrangement used in the steam drums of both locomotives, steam is collected over a wide



The draft appliances consist of a low exhaust nozzle, the stack, and a connecting cylinder of netting—There is no diaphragm or table plate

Cross sections and elevation of the "John B. Jervis"

area of water surface, and that approximately 75 per cent of the steam is generated in the firebox, the saddle and header connections between the boiler shell and the steam drums are believed to provide all the communication necessary. These pipe connections have, therefore, been omitted in the boiler of the "John B. Jervis."

Steam distribution

In the main superheater the spiral type of unit construction has been retained in the new locomotive. Each unit of this superheater consists of a single loop, the saturated end of which is formed in a spiral around the straight return pass. Attention has already been called to the increase in the number of units from 42 to 52.

The arrangement of the header is essentially the same as in the "Horatio Allen," but the use of a so-called front end throttle valve permits the superheated steam for the auxiliaries to be taken directly from the main superheater header, on which a flanged opening is cast for that purpose.

Several changes have been made in the steam pipe arrangement. In the "Horatio Allen" a centrifugal type desaturator was placed in the steam pipe on the boiler side of the throttle, which in turn was located on the boiler side of the superheater. The desaturator has been omitted in the "John B. Jervis." The double throttle valve of the former locomotive, the purpose of which was to limit the pressure to 300 lb. when operating simple, has been replaced with a new type single seat Bradford throttle which is located on the cylinder side of the superheater.

Aside from this, the principal change in the steam pipes is an increase in the diameter of the receiver pipe from 10 in. where it leaves the Mellin intercepting valve, to 14 in. where it passes over the smoke arch. The diameter of the receiver in the "Horatio Allen" was 10 in. throughout. Superheated steam for the auxiliary locomotive on the tender is taken from the high pressure cylinder branch pipe. The steam distribution is controlled by a Walschaert valve gear operating a 12-in piston valve in the high pressure valve chamber and a 14-in. double ported piston valve in the low pressure valve chamber.

The cylinders and frames are essentially of the same construction in the "John B. Jervis" as in the former locomotive. In both locomotives the main frames terminate just back of the cylinders, where they are bolted to a combined steel saddle casting and front deck plate. To this casting is bolted the high pressure cylinder on the right side and the low pressure cylinder on the left side. The smokebox saddle fit is a separate casting which is bolted to the top of the main saddle casting, thus permitting the removal of the boiler without disturbing the smokebox saddle fit or the main frame splice. In the "John B. Jervis," however, the combined steel saddle and deck casting has been redesigned and the weight reduced. A further material reduction in weight was also effected by the use of manganese cast steel for both the high and low pressure cylinders, which in the "Horatio Allen" were of cast iron. This reduction in cylinder weight is one of the principal factors in reducing the weight of the engine truck from 49,500 lb. in the case of the "Horatio Allen" to 41,500 lb. in the case of the new locomotive.

Other changes

Particular attention was given to improving firebox draft and combustion with a view to reducing cylinder back pressure and fuel consumption. To assist toward this end, the new locomotive has been equipped with a trial application of the German State Railways' type of draft appliance. In this front end arrangement all baffle plates are removed from the smokebox, and the drafting appliances consist only of a low exhaust nozzle, the base of the tip of which is only about 15 in. above the bottom of the smoke arch, a cylindrical netting enclosure which extends from the nozzle to the base of the stack, and the stack itself. Beyond these appliances there is nothing in the smokebox except the front ends of the superheater units. The header itself, as in the case of the "Horatio Allen," is located outside of the smokebox.

No outstanding changes have been made in the running gear, although there has been a refinement of some of the details. One of the changes consists in the use of Edmonds' oil lubricated driving boxes on the main pair of journals.

Special attention was given to the cab and boiler head arrangements, and a very comfortable and convenient cab is the result. Comfortable seats have been provided on both sides of the cab, that on the fireman's side providing room for the head brakeman as well as the fireman. Particular attention was given to the ventilation of the cab and clear vision front windows are provided on both the right and left sides.

In order to eliminate stopping heavy freight trains for fuel and water, a larger-capacity tender has been used with the "John B. Jervis." This has a capacity of 16,000 gal. of water and 20 tons of coal. It is carried on a Commonwealth six-wheel front truck and a six-wheel Bethlehem auxiliary locomotive at the rear. Barco 2½-in. metallic connections are used between the engine and tender and between the tender frame and the truck in the 400-lb. pressure steam line to the auxiliary locomotive.

The "John B. Jervis" is reported to have gone into service in a very satisfactory manner both with respect to the running of the machinery, the steaming capacity and the superheat. The steaming has been exceptionally free and it is reported that it has been necessary to keep the fire door open a considerable part of the time to prevent loss of steam through the pops. The new throttle has proved to operate very satisfactorily and to be entirely free from any leakage. In order that accurate data may be obtained with respect to the performance of the locomotive, dynamometer car tests will be made.

Table of dimensions, weights and proportions of the "John B. Jervis"

Railroad	Delaware & Hudson
Type of locomotive	2-8-0
Service	Freight
Cylinders, diameter and stroke	22¼ in. and 38½ in. by 30 in.
Valve gear, type	Walschaert
Valves, piston type, size	12 in and 14 in.
Weights in working order:	
On drivers	295,000 lb.
On front truck	41,500 lb.
Total engine	336,500 lb.
Tender	303,000 lb.
Wheel bases:	
Driving	18 ft.
Rigid	18 ft.
Total engine	29 ft.
Total engine and tender	74 ft. 11½ in.
Wheels, diameter outside tires:	
Driving	57 in.
Front truck	36 in.
Journals, diameter and length:	
Driving, main	12 in. by 14 in.
Driving, others	11 in. by 14 in.
Front truck	7 in. by 15 in.
Boiler:	
Type	Combined water and fire tube
Steam pressure	400 lb.
Fuel, kind	Mixed anthracite and bituminous
Diameter, first ring, inside	61⅞ in.
Firebox, length and width	152 in. by 77⅝ in.
Arch tubes, number and diameter	6-3½ in.
Fire tubes, number and diameter	101-2 in.
Fire flues, number and diameter	52-5½ in.
Length over tube sheets	15 ft.
Grate area	82 sq. ft.
Heating surfaces:	
Firebox	1,150 sq. ft.
Arch tubes	67 sq. ft.
Fire tubes	788 sq. ft.
Fire flues	1,116 sq. ft.
Total evaporative	3,121 sq. ft.
Superheating	700 sq. ft.
Comb. evaporative and superheating	3,821 sq. ft.

Tender:
- Water capacity ....16,000 gal.
- Fuel capacity ....20 tons

General data estimated:
- Rated tractive force:
  - Cylinder, simple ....85,000 lb.
  - Cylinder, compound ....70,800 lb.
  - Auxiliary locomotive..................18,000 lb.

Weight proportions:
- Weight on drivers ÷ total weight engine, per cent 87.6
- Weight on drivers ÷ tractive force, simple3.5
- Weight on drivers ÷ tractive force, compound 4.17
- Total weight engine ÷ comb. heat.surface.88.2

Boiler proportions:
- Tractive force, comp. ÷ comb. heat. surface 18.5
- Tractive force, comp. × dia. drivers ÷ comb. heat. surface...................1,056.0
- Firebox heat. surface ÷ grate area......14.0
- Firebox heat. surface, per cent of evap. heat. surface 36.9
- Superheat. surface, per cent of evap. heat. surface 22.4

The shop draftsman and his duties

Acts as interpreter of mechanical policies—Work offers many opportunities for varied experience

By Warren Ichler

THE term "shop draftsman" as used in railroad organizations is understood to mean a qualified draftsman, detached from the central drafting room which serves the entire system and assigned permanently to a sub-division of the mechanical department of the system. When this allocation has been made, the draftsman thus placed is put under the supervision of a division master mechanic, or, when assigned to a main shop serving several divisions or the entire line, he is responsible to the shop superintendent.

The shop draftsman, though under the direct supervision of divisional or local officers, is still attached to the central drawing office in the sense that his is the responsibility for interpreting the general mechanical policies of the system to the shop organization. He reports to the chief draftsman and, in a broad sense, is the liaison officer between the chief draftsman and mechanical engineer on one hand and the shop superintendent or master mechanic on the other. As such, he may be an interpreter and recorder of the general policy orders issued from the higher mechanical officers, a custodian of records, a supervisor of betterment projects—anything, in fact, that the necessities of his location dictate and for which his capabilities fit him.

Capabilities, in the case of a shop draftsman, should be construed in the broadest sense. Preferably he should have a wide practical experience in addition to more than ordinary drafting ability, for his work cannot be limited to any special feature of railroad repair work. Working alone, as he must, it is obvious that he must have more than ordinary familiarity with machining and assembling operations, boiler and tank work, car repairs, shop arrangement and maintenance; in short, with all railway mechanical operations.

Certainly no progressive shop draftsman need complain of a limited outlook or of routine work. The whole tendency of his work is away from routine matters and while draftsmen of lesser experience and ability have occasionally been placed in these positions because they did not fit into the centralized organization, these men have utterly failed to realize the possibilities of their jobs and to be of maximum value to themselves or to their employers.

It must be first noted that the shop draftsman is custodian of the drawing files of the shop. In this capacity he will have to devise his own filing and check-out systems and will probably have to train a clerk or apprentice in that system in order to avoid confusion in the files when his duties call him away from the office. He will have to advise the central mechanical headquarters of unavoidable or intentional departures from standard drawings, transmitting this information preferably by means of prints corrected to shop practices—by correspondence, if pressed for time.

In so far as possible, he will anticipate the needs of the shop for new and revised drawings and keep his files as complete as those of the central drawing office. This work in connection with drawing files and correspondence is usually the only purely routine work of the job.

Shop draftsman should follow shop developments

Every railroad mechanic is familiar with the vast amount of development work that goes on, often unrecorded and unnoted until called to the attention of some mechanical officer. Attachments for shop machines, jigs, fixtures, etc., are among the minor facilities subject to constant improvement and often a meritorious practice or device will be confined to one division on a large system merely because of the lack of sketches or a description. One progressive shop draftsman had what he called his "reportorial hours," certain periods set aside each week for talks with tool foremen and other supervisors for the collection of data on shop tool improvements needed, pending, or completed.

Of course, most of the betterment projects are major ones, subject to authorization, development and approval by mechanical headquarters, and with these, the shop draftsman has to act as an interpreter of drawings and policies, an adviser and an instructor to the shop force. Often in addition to these duties he has to act as adviser to storehouse forces to keep them informed in advance of the material needs of the shop. Such projects as the rebuilding of locomotives or re-equipment of locomotives or cars with improved accessories consume a vast amount of drafting room time until they are thoroughly understood by shop and store forces alike.

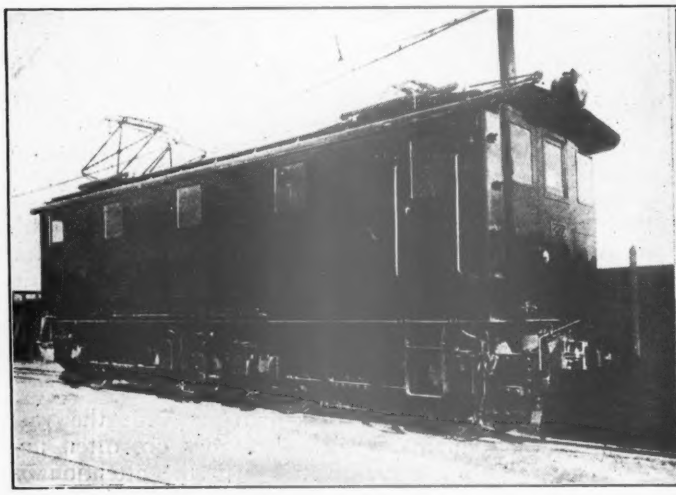
Although nearly all of the Class I carriers are now maintaining permanent valuation organizations, a lot of the reporting of minor projects falls to the shop draftsman as a matter of economy. Such improvements as the installation of short pipe lines, reinstallation of temporarily unused machines, tools or facilities not included in original inventories, are all better handled by the man on the job than by an inspector sent at some expense from a central office. This does not mean that valuation inspectors can give absentee treatment to all A. F. E. projects, but it does mean that in many minor

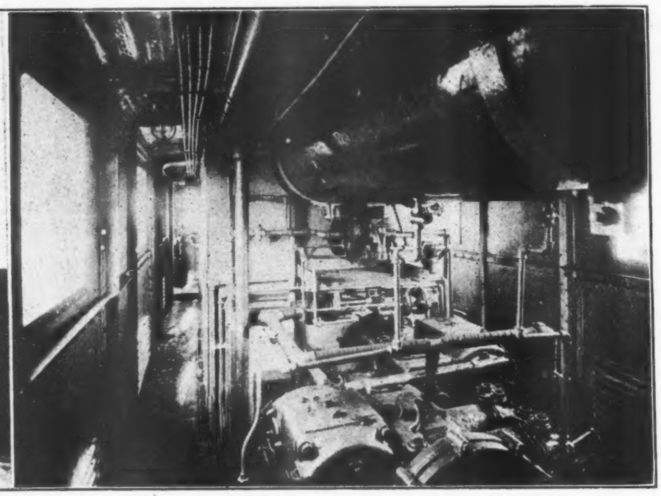
cases they can make their governmental reports and summations from data furnished by a draftsman.

Some shop draftsmen are utilized as apprentice instructors and others, not under orders covering such work, find time to conduct night classes for apprentices and mechanics. It is common practice in the railway shop that where apprentice schools are not maintained the shop draftsman shall be considered as an apprentice instructor by virtue of his training and experience. Some railroads include in the training of special apprentices or ordinary apprentices who show unusual ability and promise a three months' course of training under a shop draftsman. Even with all the interruptions of his work, a first-class shop draftsman is usually able to make these three months interesting and profitable to the average boy, though it must be admitted that there is a great temptation to overburden the apprentice with routine work connected with the filing of the drawings.

In rare instances, shop draftsmen are loaned to departments other than the mechanical, for the mapping of pipe lines, extensions to wheel tracks, alterations of shop buildings, etc. Occasions where shop draftsmen have had to give lines and grades for iron-racks, outlying storage sheds, wheel drop pits, industrial tracks, surface drainage ditches, etc., are probably common.

These are just a few suggestions as to how a shop draftsman at an outlying division headquarters may be profitably employed by his superiors. From experience, it may be said that usually the main difficulty lies in trying to crowd some 18 hours of work into the eight-hour day allotted to him. If he does find time hanging heavily on his hands, he can always manage to employ it at the thing which he is supposed to be best fitted for—the making of drawings.





Exterior and interior views of electric locomotive built for the Fuji Minobu Railway Company, Japan, by the Kawasaki Dockyard Company, Kobe, Japan

The principal characteristics of the locomotive are as follows: Total weight, 55 tons; weight of mechanical parts, 33 tons; weight of electrical parts, 22 tons; voltage, 1500 d. c.; gage of track, 3 ft. 6 in.; diameter of driving wheels, 49 in.; tractive force (1 hour rating), 19,500 lb. at 19.25 miles an hour. Auxiliary equipment includes Westinghouse type 14 EL air brake, electric rheostatic brake, hand brake, motor generator for control and lighting, motor driven blowers, motor driven air compressors, heaters and a General Electric high speed circuit breaker.

Second annual banquet of the Ladies' Auxiliary Maintenance of Equipment Athletic Association, Sayre, Pa., system shops, Lehigh Valley, held February 18, 1927

Lacquer finishes as applied to passenger cars

More extensive use is being made of lacquer—Hard surface facilitates cleaning

FOLLOWING are abstracts of two papers on the subject of lacquer finishes as applied to passenger cars which were presented at the sixth bi-monthly meeting of the Southern and Southwestern Railway Club, held November 18, 1926, at the Hotel Ansley, Atlanta, Ga. The first paper was presented by H. Hengeveld, master painter, Atlantic Coast Line, Waycross, Ga., and the second by R. M. Cook, E. I. duPont de Nemours & Company, Parlin, N. J. Mr. Cook discussed in his paper the application of lacquer finishes to locomotives as well as to passenger cars.

Abstract of Mr. Hengeveld's paper

When lacquer finish was first introduced, adequate facilities for its efficient application were conspicuous by their absence and workmen were generally unfamiliar with and unsympathetic toward these strange materials and tools they were called upon to use. I therefore felt a delicacy at that time, in advocating its use, knowing very little of the virtues it contained or the possibilities it represented.

There are several methods of applying lacquer so that it will make a presentable appearance upon completion. My experience leads me to believe, however, that only two of the many methods employed are worthy of serious consideration.

For the purpose of comparison we will designate them as the long and short method and for the long method the following formula is suggested: After a car has been properly prepared by thoroughly sandblasting, removing all the old paint, scale and rust, continue as follows:

First day—Prime. Allow 24 hours for drying.
Second day—Intermediate coats. Allow 24 hours for drying.
Third day—Putty and knife in. Allow 24 hours for drying.
Fourth day—First coat of surfacer. Allow 24 hours for drying.
Fifth day—Second coat of surfacer. Allow 24 hours for drying.
Sixth day—Rub or sandpaper.
Seventh day—Seal coat.
Eighth day—Two or three coats of lacquer. The third coat is not always necessary, two coats being usually sufficient to obtain a reasonable depth of film.
Ninth day—Letter and stripe. Pyroxylin lettering enamels are now on the market which need no protection after being applied.

You will note that it takes nine days to complete a car by the long method. After the car is prepared in a similar manner as outlined in the long method, the procedure of the short method is as follows:

First day—Prime. This primer will be thoroughly dry within one hour, when a coat of No. 2 surfacer is applied. This will also dry in one hour. The car can now me puttied. Time consumed, one day.

Second day—Glazing or knifing—in material should be applied. This should be done with a glazing knife of sufficient width to level properly all uneven places.

Third day—If the car is in such condition that additional coats are necessary to produce a smooth and even surface, one or two coats of surfacing material reduced to proper consistency to apply with either spray or brush can be applied on this day.

Fourth day—The car is now ready for rubbing. My experience has been that the best results are obtained by the use of what is known as Trimite paper. This can be used dry or in water. I would suggest starting this operation with No. 180 and finish with No. 220. Sufficient force should be used on this operation to complete it in one day.

Fifth day—The car is now ready for what is known as a seal coat. One coat of this must be applied to properly seal and provide a uniform coating on which to apply the lacquer coats.

Sixth day—Apply two or three coats of lacquer in the morning, lettering the car in the afternoon.

Objections to lacquer are being overcome

The mechanical application of this material is such a radical departure from old time methods that those who are opposed to it are inventing all kinds of excuses to prevent its adoption. The principal objection is that

the peculiar fumes of lacquer finishes are poisonous.

This question has been investigated in minute detail by the National Paint and Varnish Association's Industrial Research Laboratories, Washington, D. C., and with the exception of bensole, which every legitimate manufacturer has eliminated from his lacquer, the poisonous properties were found to be less, or not more than turpentine.

Furniture manufacturers found in lacquer a quicker and more durable finishing material. But the most startling chapter in its history has been written by the automobile industry, which has nearly adopted lacquer to the entire exclusion of other finishing materials. All automobile companies in this country today use lacquer on some of their output. A great majority finish all of their cars in lacquer in spite of the fact that most of them began its use less than three years ago.

Possible use of lacquer for priming and surfacing

Although the priming and surfacing coats on nearly all railroads today are still made of slower drying materials, some roads are experimenting with lacquer primers and surfacers as well as lacquer finishing coats. It is probable that others will follow their example, thus entirely dispensing with baking equipment.

Both the slow and quicker methods of undercoats are now undergoing service tests on our road and from present observation, I am inclined to believe the quicker method will be finally adopted as the most economical and practical.

I might mention here that we are also applying lacquer over old surfaces and while not as yet willing to go on record that it will proce as durable as a newly prepared surface, our experience so far has been satisfactory.

Application is not a difficult problem

The application of lacquer is not a difficult operation. A workman familiar with the spraying of paint soon becomes proficient in the application of lacquer. It has excellent possibilities, but in order to obtain the best results the operator must be in harmony with the object to be obtained. That may need a little explanation. For instance, if a man, who applies the lacquer to a car, is not in sympathy with the management, he can ruin that car while your back is turned. If a man is willing to do the job as it should be done, there is no reason why it should not be a success. Ninety per cent of the variation in the application of laquer in my opinion is due to the operator.

The Atlantic Coast Line has, after investigation and experiment, adopted this advanced method of finishing their equipment and only recently completed 73 new steel passenger cars with this system and are applying the same material on all steel passenger equipment undergoing general repairs at our local shops.

We have nearly eliminated the paint brush, using the spray whenever and wherever possible on all classes of equipment and I can state that workmen who were pessimistic when this method was first introduced, would regret exceedingly if we required them to return to the brush method.

The greatest economy of labor ever effected in applying paints, enamels, varnishes or lacquer, has been since the introduction of the spray gun. When the spray guns were first introduced, they were, more properly speaking, squirt guns that applied the paint in uneven splotches and which ran and sagged in such a manner as to present a very uneven appearance. It also frequently alligatored and cracked. In recent years, however, the improvement in spray guns has been so great that even coats can be applied which present as smooth an appearance as the same material would if applied with a brush. In fact it requires less experience to get a smooth job with a gun, if the materials are properly mixed, than it would to apply them with a brush.

Proper precautions will eliminate fire hazard

A great deal has been said about the fire hazard in applying lacquer. The fire hazard in paint shops on account of the use of inflammable materials such as turpentine, varnishes, etc., has always been greater than in nearly all other departments. I believe, however, that with proper precaution, intelligent supervision and sufficient ventilation, removing the fumes as rapidly as possible, this question will, like many others, solve itself. In fact the fire hazard is largely overestimated.

The question is often asked in what respect is a lacquer film better than the varnish and enamel system heretofore in use. My answer to this question is that it is a finish with a longer life of good appearance and effective protection, a finish easily patched after collision or other damage, a finish where the cleaning cost is materially reduced, that it does not check or crack to the same extent as a varnish or enamel finish, and that it is not effected by sudden changes in temperature.

Lacquer for passenger cars and locomotives

By R. M. Cook

District sales manager, railway sales, E. I. duPont de Nemours Company, Parlin, N. J.

Lacquer in its present state is a solution of nitrocotton or pyroxylin, together with a small percentage of gums. This makes clear lacquer. When pigments are ground in, the colored lacquer is produced. When this is applied to a surface, the solvents quickly evaporate, leaving behind a tough hard dry film. The drying is entirely by evaporation, whereas, with a paint or varnish, film drying is by oxidation and this oxidation continues until the checking or crazing results. A lacquer film on the other hand is a stable and chemically non-reactive, inert material with no chemical change taking place during its life. The wearing away of the film consists merely of a slow erosion such as rocks and minerals undergo during exposure to the elements. Let us now consider the following items of reduced cost:

Decreased shop time required for finishing—A lacquered car can be finished from the metal surface in seven days as compared with a minimum of 13 days for the varnish system. This enables equipment to be returned to service and thereby earning revenue five to six days earlier and according to the usual basis of calculations, this is a saving of $125 to $150 per car.

Increased shop capacity and decreased capital investment—By reducing the time required, the railroad can pass more cars through the paint shop in a given period. This increases the capacity of the present shops and obviates the necessity of expansion of old paint shops or erection of new ones, since the present capacity of shops will be practically doubled.

Increased paint shop efficiency—Experience shows that by the use of lacquer the paint shop efficiency can be materially increased in many shops. In the past, the paint shop has been congested by reason of the inability to get cars through fast enough to take care of coach shop repairs. This is remedied by the use of lacquer.

These advantages are connected with the application

of the material. The advantages actually existing in the film itself are of equal importance.

Increased durability of the film—Railway cars in service constantly for three years have shown no deterioration. We know today that the proper kind of lacquer will last at least three times as long as other finishing materials.

Decreased terminal cleaning expense—Cars finished in lacquer can be dry wiped with much better results than can other finishes. The latter being comparatively soft, allow dust, grit, etc., to become imbedded in the film. Lacquer dries quickly with such a hard, tough film that dirt merely lies on the surface and is readily removed by wiping. If washing is desired, grease, oil, etc., can be removed with soap solutions or acid of alkali cleaners without damage. This applies to exteriors and interiors. In the latter case the advantage over washing varnish is marked because with lacquer the finish is improved and with varnish the rubbed effect is almost destroyed. One railroad makes the statement that terminal cleaning expense has been decreased 50 per cent by the use of lacquers.

Elimination of rubbing cost on interiors—The soft satin effect of lacquer on interiors makes rubbing unnecessary, thereby saving all rubbing costs.

Decreased expense in annual upkeep—Your present practice of shopping cars every 18 months or two years for light repairs and recoloring or revarnishing can be modified. With a lacquer finish, a very large percentage of the cars can be simply scrubbed and thoroughly cleaned and immediately returned to service after mechanical repairs are made. Physical damage to the film can be quickly repaired, renewing only the damaged portion. This is possible with lacquer and equally impossible with varnish or paint, by reason of fading of the latter.

Saving by quick patching of new cars damaged in the shop—It is inevitable that some cars in being finished will be scratched or cut by sharp tools. These damaged spots can be repaired and disguised in half a day by the use of lacquer primer and putty.

General appearance—Cars finished in other than lacquer show the effect of cleaning and of the elements within 30 days. The original appearance of the lacquered car is that of satin, which appearance is kept up by cleaning and in fact the lustre is increased rather than decreased. A newly varnished car stands out painfully conspicuous in a train of cars, the rest of which have been in service, even though they have been cleaned. That is not the case with a lacquered car, the appearance of which is softer and in harmony with the rest of the train.

On interiors the soft, satin finish, the pleasing combinations of durable fast colors, the smooth finish free from brush marks and the permanency of this finish even under severe conditions of cleaning and washing, make the lacquer finish almost an ideal one. This applies to wooden as well as metal cars. A flexible lacquer has been developed and tried out for two years with excellent results. Decorative stripes, etc., can be applied with brush lacquer with entirely satisfactory results.

Lacquers have been developed for many uses

Lacquer has all the advantages for busses, or gas-electric cars that it has for passenger cars and locomotives. No mention has been made of undercoats. Lacquer itself is a finishing material taking the place of color coats and varnish. Undercoats used are generally those of the usual oil type, but especially formulated to be used under lacquer to give the best results. Some work has been carried out with lacquer undercoats. So far as railway cars are concerned, this is still in an experimental stage. The use of oil type undercoats with lacquer finish is a proved proposition.

Lacquer can be used to great advantage in finishing or refinishing linoleum strips, rattan seats, imitation leather seats, thus including all the items of a railroad car.

So far this discussion has included only finishing from the bare wood or metal. Lacquer can be applied over the old paint undercoats if they are good enough to be finished again in varnish. Small holes and blemishes can be puttied after the car has been washed and finished the next day in lacquer, making a two-day job. An extra day would be required if there was much in the way of decoration: gold leaf can be saved by the use of a shield coat or mascote. This is a later development which has been very successful.

While it is true that best results are obtained if the lacquer is sprayed on, brush lacquer has now reached a point in its development where it can be recommended for small shops where the spray method is impossible.

So far as the storage and application of lacquer is concerned, little more in the way of precautions are necessary than is the case with spraying paints and varnishes. However, it is necessary to call the attention of all those connected with the spraying and handling of the materials to the fire hazards involved and to see that necessary precautions are observed. The quicker evaporation of the lacquer solvents naturally saturates the air with flammable materials to a greater extent than is the case with the slower drying paints and varnishes and these vapors must be removed by ventilating fans. This subject is ably taken care of by the recommendations of the Railway Fire Protective Association.

Briefly, the initial cost of the use of lacquer is about the same as for other finishing materials, but thereafter every item of expense in connection with refinishing or cleaning of the coach is less and the time between refinishing periods is greatly lengthened.

Discussion

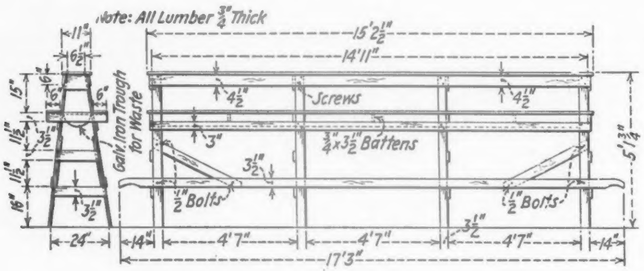
The question was asked in the discussion as to whether there was any difference in the durability of lacquers between that applied with a brush or a spray gun. Mr. Cook replied that in general there was no difference. The difference that enables the painter to make an application of lacquer with a brush is in the solvents. The material remaining after the evaporation of the solvents themselves is the same. Brush lacquer can be applied with as durable a film as with the spray.

Another question asked was what is the best method of cleaning cars finished with lacquer? Mr. Hengevelt stated that the best method was to use clean water. He illustrated this with an example of a private car finished with lacquer that had been in service for a number of months. This car was sent into his shop to be relacquered, but after making an inspection, he decided that the car was dirty and had not been properly cleaned. Instead of relacquering the car it was cleaned with water and a weak solution of soap. A few bruised spots on the car were touched up with a brush and the car left the shop in almost perfect condition. Another question was asked relative to the lacquering of window curtains and it was brought out in the discussion that a number of roads had been applying lacquer by the spray method to both sides of the curtains and had been getting satisfactory results. A special lacquer to which certain ingredients have been added to give flexibility, however, was used for this particular job. It was also brought out in the discussion that several roads were not only using lacquer for exterior finishes, but for metal ceilings as well.

Portable scaffold for the coach cleaner

By E. A. Miller

SHOWN in the sketch is a scaffold designed to facilitate the work of cleaning coaches at terminals. It is constructed of ¾-in. lumber and is 5 ft. 1¾ in. high by 17 ft. 3 in. long. A platform 6 in. wide is provided



A portable platform for coach cleaners

on both sides of the scaffold, 57½ in. above the ground for the car cleaners to stand on. The top of the scaffold, which is 15 in. higher, is 11 in. wide and is intended to be used by the car cleaners to set their cleaning materials on. Handles are provided, as shown in the sketch, so that the scaffold may be carried by two men to any desired location.

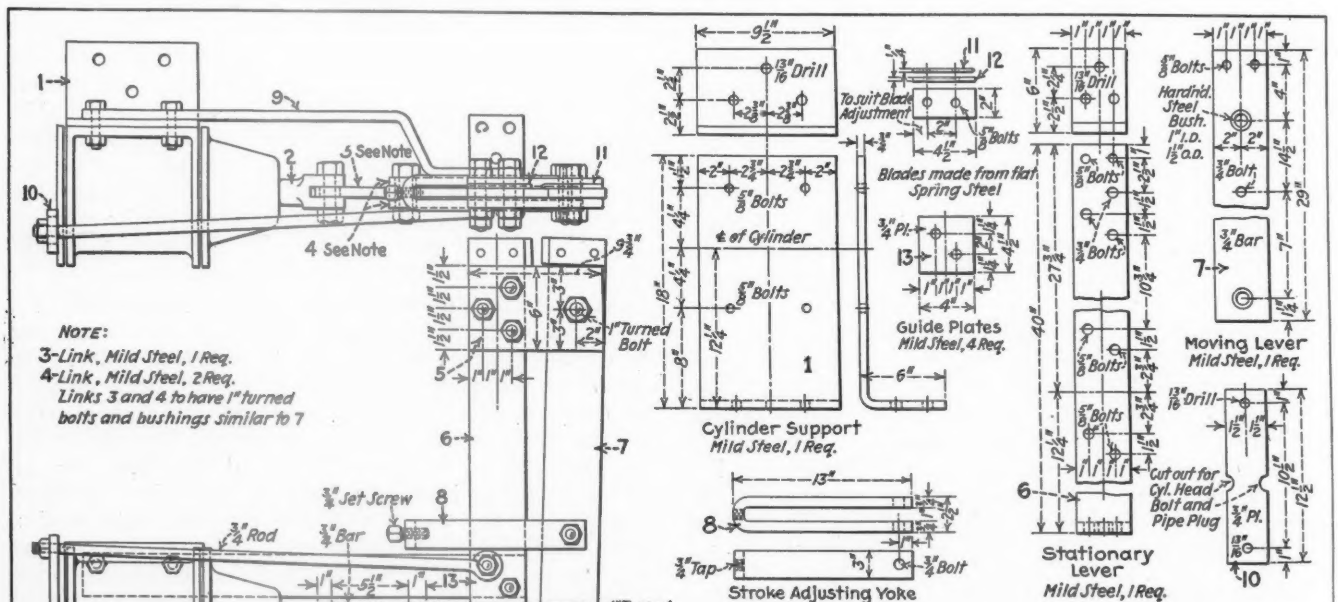
Air and steam hose clamp bolt clipper

THE illustration shows a hose clamp clipper designed at the Emerson Shops of the Atlantic Coast Line for cutting off the bolts which hold the clamps on air and steam hose when demounting unserviceable hose. The method of removing these bolts before the design of this device was to clamp the bolt head in a vise and remove the nut with a wrench, saving such bolts as looked suitable for further use; but this method, beside being too slow, made the old bolt cost more than a new bolt. With increased demands for hose fittings for remounting air and steam hose, an air-operated bolt clipper was designed. The machine is simple, rugged and effective, with a capacity to cut 600 air hose clamp bolts per hour. It is operated by an 8-in. by 7-in. brake cylinder, the air pressure for which is obtained from the shop line. Substantial savings are being effected by its use.

Blow-off valve.—The Eckenroth automatic reseating blow-off valve is described, and its construction illustrated in a four-page folder issued by the Riley Power Equipment Company, Milwaukee, Wis.

Electric furnaces for laboratories and shops.—Electric furnaces, designed for general use in chemical and physical laboratories in connection with the heat-treatment of materials, incinerations, ash and fusion determinations and research and experimental work generally, are described and illustrated in a 16-page bulletin issued by Automatic & Electric Furnaces, Ltd., Elecfurn Works, Farringdon Road, E. C. 1, London, England. The furnaces are manufactured with heating chambers of three standard patterns. All the furnaces are suitable for temperatures up to 1,000 deg. C. and can be operated on either alternating or direct current of any standard voltage.

Tooling methods for turret lathes.—About a year ago the Warner & Swasey Company, Cleveland, Ohio, announced the publication of a booklet dealing with bar work on turret lathes—this being the first of a series of three publications devoted to the use of a line of specially developed turret lathe tools. The booklet on bar work was followed somewhat later by the second and third booklets of the series which dealt specifically with chuck work. These three booklets have been combined in a new edition entitled "Modern Tooling Methods for Turret Lathes" which, in convenient form, presents practical information and suggestions for the correct handling of turret lathe tool equipment for both large and small lot production.



Assembled view and detailed parts of hose clamp bolt clipper

One of the new double-sheathed box cars purchased by the Central Railroad of New Jersey

C. R. R. of N. J. buys steel box and automobile cars

Based on A.R.A. recommended design—Same construction adopted for both types as far as possible

THE Central Railroad of New Jersey has recently placed in service 800 steel box cars and 200 steel automobile cars, in which A.R.A. recommended box car design has been followed as far as possible. Four hundred of the box cars were built at the Middletown, Pa., plant of the Standard Steel Car Company and the remaining 400 box cars were built at the Johnstown, Pa., plant of the Bethlehem Steel Company. The automobile cars were built at the Berwick, Pa., plant of the American Car & Foundry Company. The box cars were purchased primarily to handle increased business and also to replace a number of 30-ton box cars that had been dismantled. These cars are designed for use in general traffic. It is intended, however, to use them for cement traffic as much as possible, and for that reason considerable pains have been taken to insure a watertight roof and interior. A flexible roof was selected which would conform readily to any weaving of the car body.

Both cars are of similar construction

The design of the box and automobile cars has been carried out along the same lines as far as possible. A comparison of the general dimensions is shown in the table.

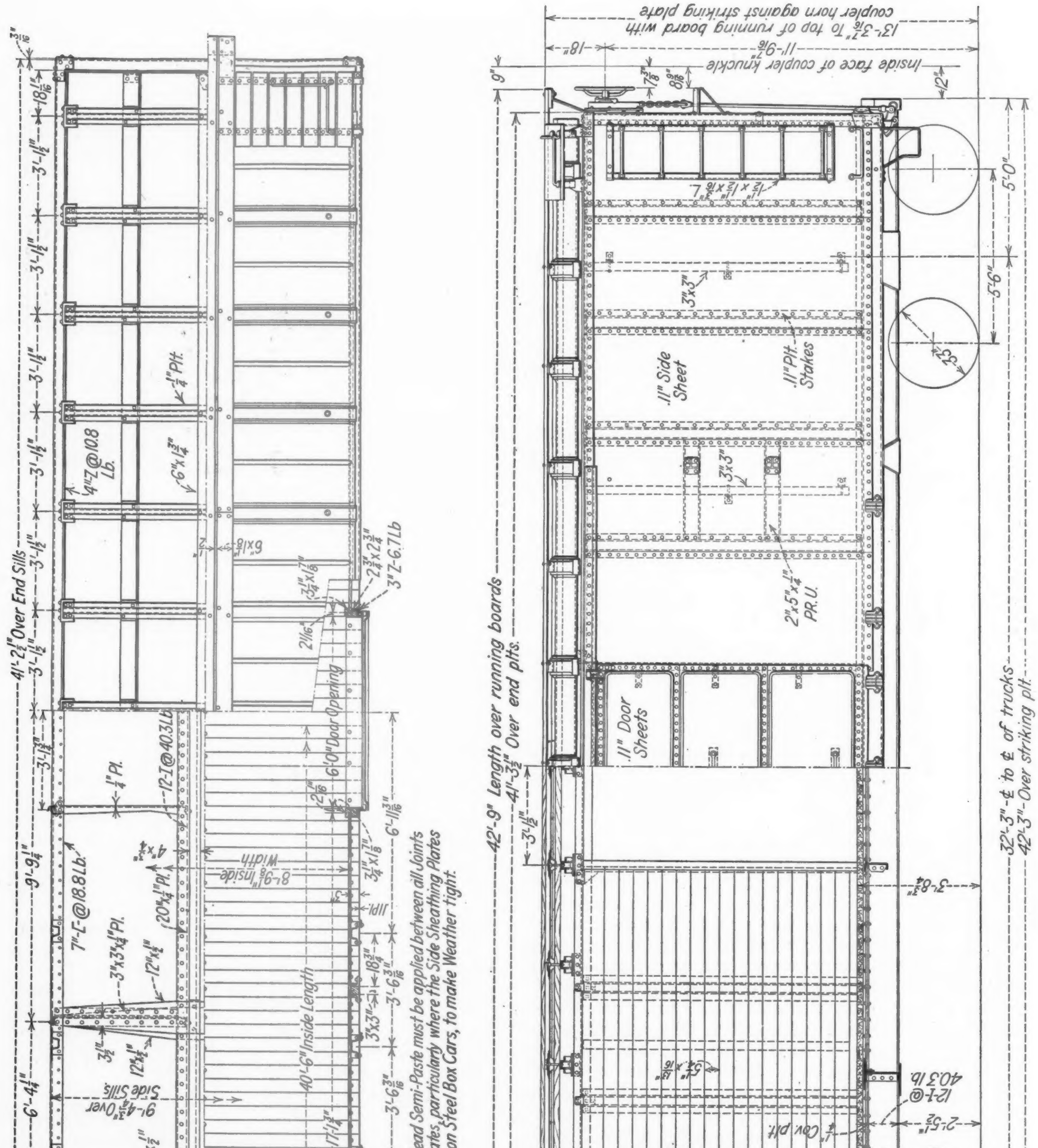
The underframes of both the box and automobile cars are of steel, the general arrangement being in accordance with A.R.A. designs. The center sills of the box cars consist of a rolled steel special A.R.A. section, 12 in. in depth, weighing 40.3 lb. per ft., and extend continuously between the end sill striking plates. A cover plate of copper bearing steel is used, ¼ in. by 20 in. and 41 ft. 3¼ in. long.

Comparative dimensions of the box and automobile cars

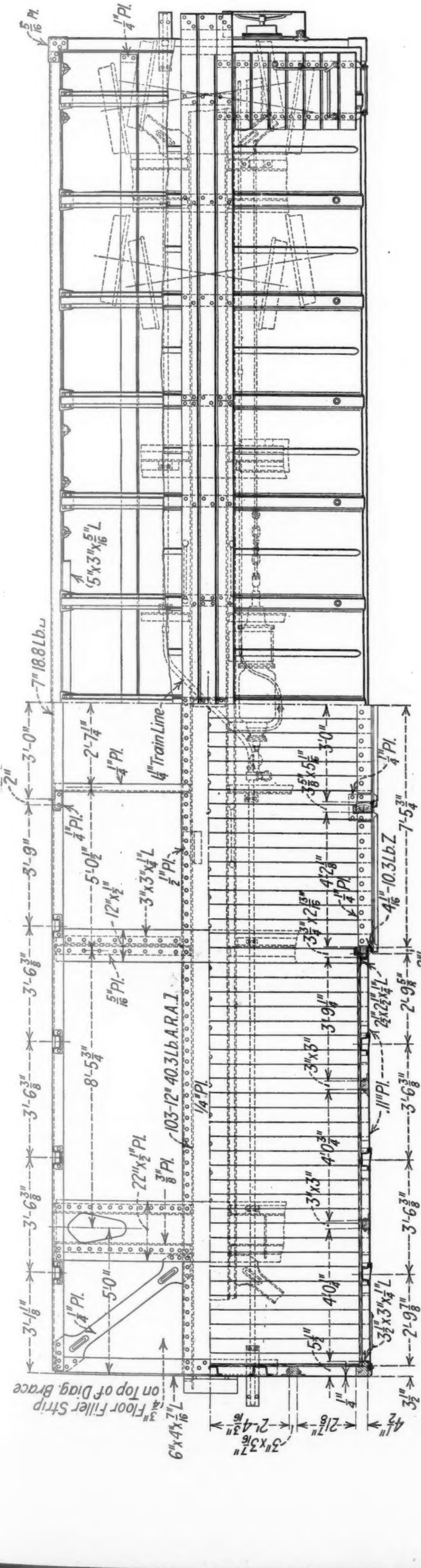
	Box cars	Automobile cars
Length over striking plates	42 ft. 3 in.	42 ft. 3 in.
Length inside	40 ft. 6 in.	40 ft. 6 in.
Width over side plates	9 ft. 5⅝ in.	9 ft. 8½ in.
Width over side sills	9 ft. 4¾ in.	9 ft. 7⅝ in.
Width inside	8 ft. 9⅛ in.	9 ft. 0 in.
Height inside	8 ft. 7¼ in.	10 ft. 0¼ in.
Height rail to top of floor	3 ft. 8¾ in.	3 ft. 8¾ in.
Height rail to running board	13 ft. 3 7/16 in.	14 ft. 8⅛ in.
Height rail to top eaves (lat. run.-board)	12 ft. 9⅞ in.	14 ft. 1 in.
Height door opening	7 ft. 11⅞ in.	9 ft. 5 13/16 in.
Width total door opening clear	6 ft. 0 in.	10 ft. 0 in.
Distance from center to center trucks	32 ft. 3 in.	32 ft. 3 in.
Capacity of car	100,000 lb.	100,000 lb.

The body bolsters are of pressed steel channel shapes ⅜ in. thick, with the flanges turned outward. Bolster center fillers consisting of a single steel casting which includes the draw gear back stop, are applied. These parts are all riveted together and reinforced by ½-in. top and bottom cover plates which are 22 in. wide at the center.

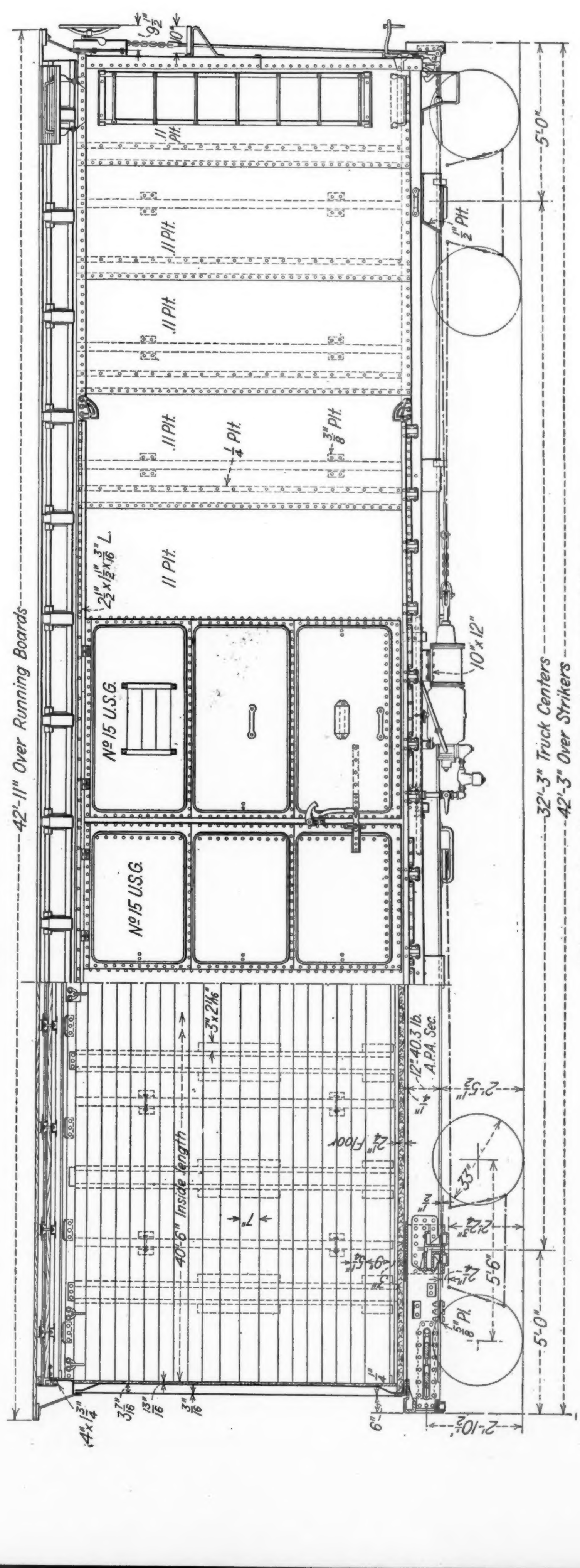
The side sills are 7-in. by 4-in., 18.8-lb. special A.R.A. channels of copper bearing steel. The end sills consist of 6-in. by 3½-in. by ⅜-in., 14.3-lb. angles, extending across the ends of the cars. There are two pressed channel cross bearers, 5/16 in. thick, which are located 6 ft. 6 in. from the center of the bolster. The cover plate is ½ in. by 12 in. and the bottom tie plate is of ½-in. by



Plan and elevation drawings of the box cars



Plan and elevation drawings of the box cars



Plan and elevation drawings of the automobile cars

12-in. material. A 3-in. by 3-in. by ¼-in. angle is applied to the cross bearer diaphragms and top cover plate. A.R.A. standard pressed channel cross ties, ¼ in. thick, are used. Pressed steel cross ties of ¼ in. material are applied three feet each side of the center line of the box car.

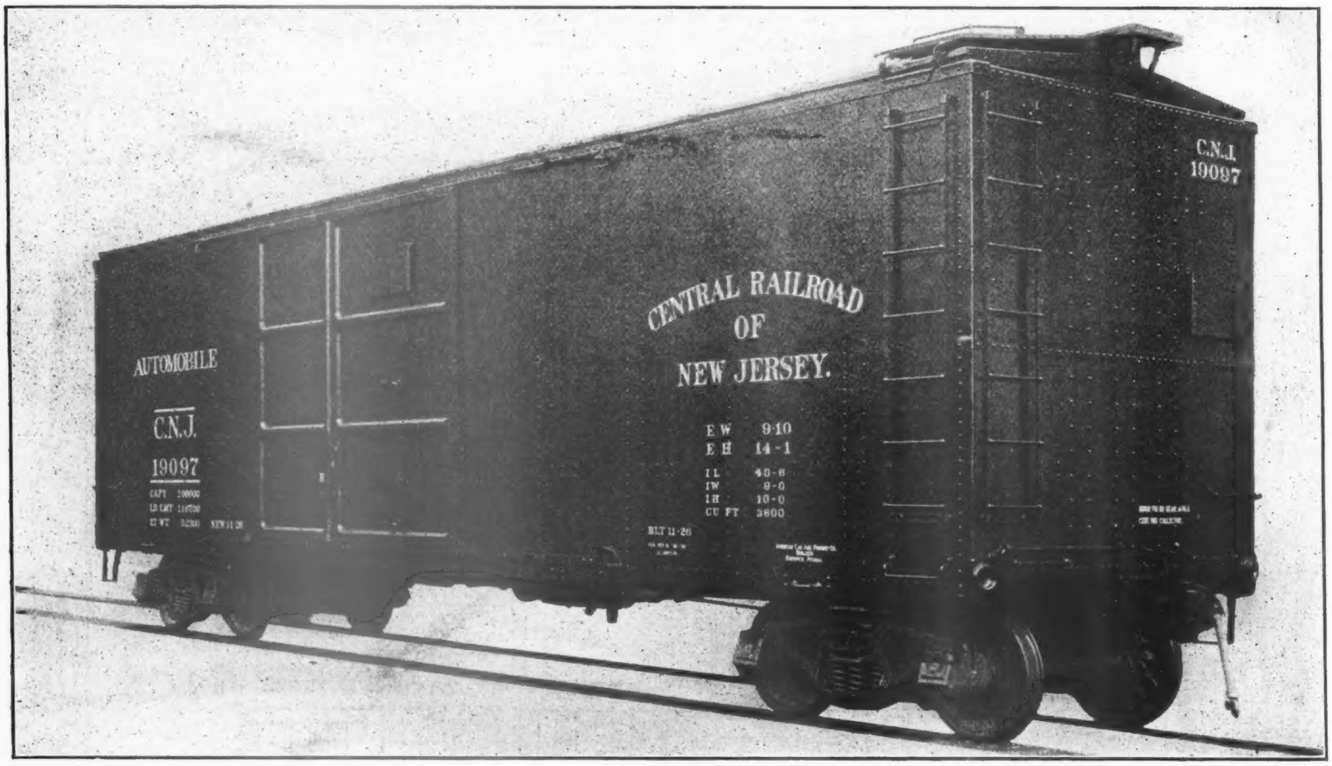
The body framing consists of 16 side posts of .11-in. pressed steel shapes, 3 in. deep, eight on each side of the car, connected to the side plates by ¼-in. flat gussets, with two ½-in. rivets to both the plate and post. The door posts are 3-in., 6.7-lb. Z-bars. The corner posts are formed by flanges of the end sheets, reinforced inside with a 3½-in. by 3-in. by ¼-in. angle at the side sheet seams.

These cars are equipped with plain steel ends. The end construction consists of a steel plate, in two sections. The top section is 3/16 in. thick and the bottom section ¼ in. thick, reinforced by three posts of 3/16-in. pressed steel. The end plate consists of a 5/16-in. pressed steel A.R.A. Z-section.

13/16 in. thick with 5¼-in. face. The side lining extends in one piece from the door posts to the end of the car. The doors on 400 of the box cars are pressed steel pans in three sections and the remaining 400 cars are equipped with corrugated pressed steel doors furnished by the Camel Company. All doors are of top hung design equipped with the Camel Company's fixtures, including the door starter.

Miner friction draft gear, class A-76-X is used with Farlow attachments. The draft gear keys are carbon steel forgings, quenched and tempered. The couplers are of cast steel, A.R.A. type D, with a 6-in. by 8-in. shank.

These cars are equipped with modified A.R.A. class 2D trucks with 5½-in. by 10-in. journals, having a 5-ft. 6-in. wheel base. The truck side frames are of cast steel, the journal boxes being cast integral with the frame and are of the Dalman type built to A.R.A. requirements. The center plate is cast integral with the bolster. One half the truck castings were made by the



One of the new automobile cars

Scullin Steel Company and the remainder by the American Steel Foundries. The Barber lateral motion device and the Miner anti-friction roller rocker side bearings and truck lever connection safety straps are incorporated in the truck design.

The side sheets are all of .11-in. steel plate riveted to the side sills, side plates and posts. The side plates are of 3⅛-in. by 4 1/16-in. by 3⅛-in. by 5/16-in. Z-bars weighing 10.3 lb. per ft. All pressed steel parts and plates ¼-in. thick and under on both the box and automobile cars are of copper bearing steel.

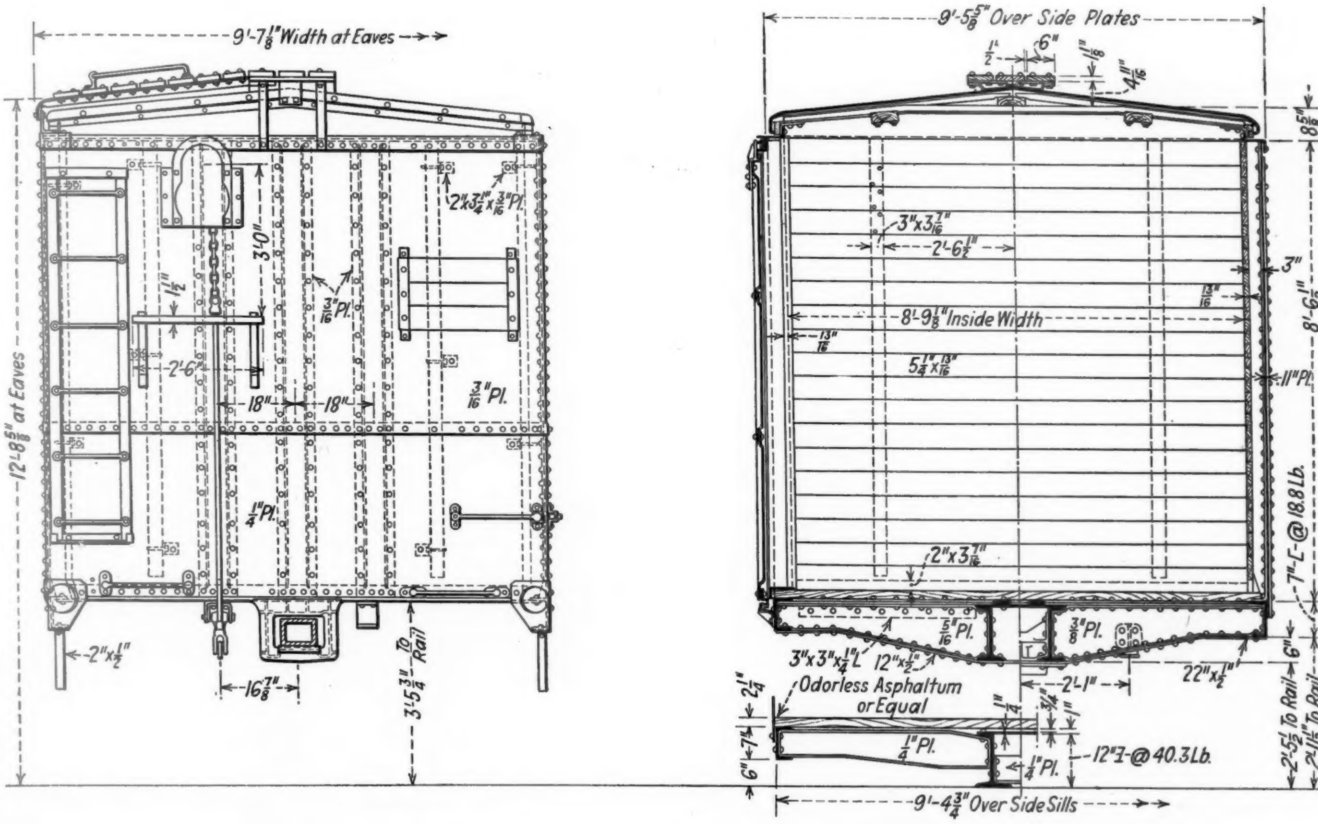
The Hutchins Dry Lading roof is used on both box and automobile cars. The sheets are No. 16 gage steel and are supported by pressed steel carlines. The ridge pole and purlines are made continuous without splices. Hutchins pressed steel running board saddles are provided.

The flooring is long leaf southern pine, tongued, grooved and dressed on both sides. It is 2¼ in. thick with 5⅛-in. face, fastened to the underframe with ½-in. carriage bolts, the heads of which are let in flush with the top of the floor.

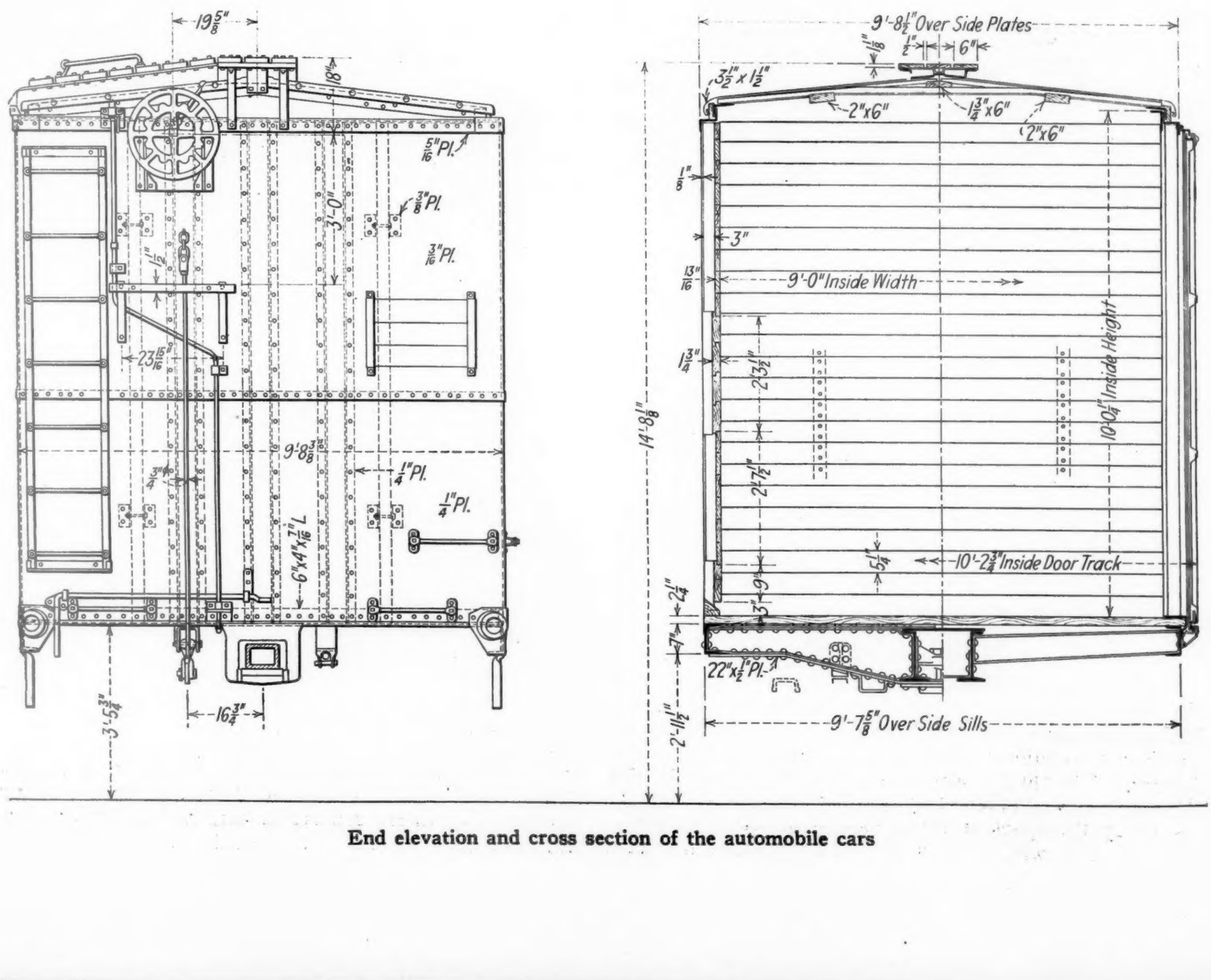
The lining is of Oregon fir, tongued and grooved,

The automobile cars

The general and detail design of the automobile cars is the same as for the all-steel box cars, except as follows: The body framing consists of 14 side posts of ¼-in. pressed steel, connected to the side plates by ¼-in. flat gussets, each of which is riveted to the side plate with three ⅝-in. rivets and to the post with two ⅝-in. rivets. The posts are riveted to the side sill at the top leg. The door posts are of 4 1/16-in., 10.3-lb. Z-bar, with the outer leg cut off to suit the door weather strip. The Z-bar is reinforced by a 2½-in. by 2½-in. by ¼-in. angle. The end posts are of ¼-in. pressed steel, three



End elevation and cross section of the box cars

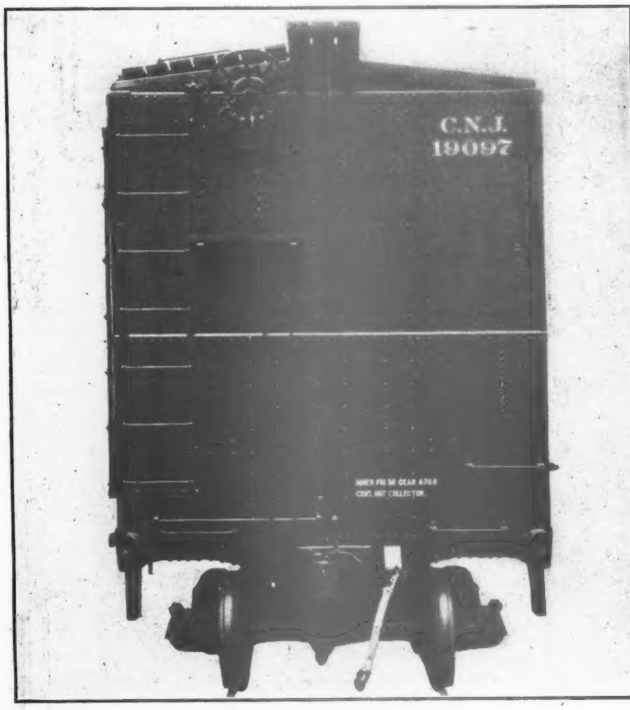


End elevation and cross section of the automobile cars

at each end. The end sill angles are 6 in. by 4 in. by 7/16 in.

The side plates are reinforced at the door opening with a 5-in. by 3-in. by 5/16-in. angle, 13 ft. long. Nailing posts are located between the side posts. Fillers 3 in. by 2 1/16 in. are used at both sides of each side post and at the corner and door posts behind the lower lining boards and behind the center lining boards. The side lining is so arranged that the lower board is of 1¾-in. by 9-in. face, ship lapped, the bottom edge being set 3 in. above the top of the floor. Tongued and grooved lining 13/16-in. by 5¼-in. is used above this board. There are six boards of this size, then four boards 1¾-in. by 7½-in., ship lapped, and the remaining boards are 13/16-in. by 5¼-in., tongued and grooved.

The side doors are bottom supported and allow a



End view of the automobile car

clear opening 10 ft. wide and 9 ft. 5 13/16 in. high. The steel doors are made in two sections. One section is 6 ft. 3¼ in. wide, located at the center of the car and the other 4 ft. 7 9/16 in. wide. Both doors are of pressed steel pans in three sections. Camel-Gilroy door fixtures are used, which include removable side door posts with automatic top and bottom locks and reinforced post and door spark strips, door starter and closer.

There are 24 wrought iron lifting rings on each car, secured to the side and end plates by wrought iron brackets with two ⅝-in. diameter rivets in each bracket. Four roping staples are provided which are located on the side sills near each bolster.

Special equipment

Both the automobile and box cars are equipped with the same appliances except that Buffalo brake beams, brake beam supports and National Malleable and Steel Casting Company's steel couplers are used on the former. The brake equipment for both cars is the Westinghouse quick service, retarded release type, schedule KC-1012 with a 15-30-lb. pressure retaining valve and K-2 triple valve. All the air piping is of wrought iron, double strength. The brake beams on the box cars were furnished by the Damascus Brake Beam Company while the brake beam safety supports are of the Creco Drexel type on 400 of the box cars and Buffalo brake beam supports on the other 400 box cars. The brake beam hangers which are of the self locking type, as well as the truck lever bottom connections are furnished by the Schaeffer Equipment Company. The hand brakes are of the Ajax type, connected through a bell crank to the cylinder push rod. The Hutchins Car Roofing Company's uncoupling levers are also used on both the box and automobile cars.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Original repairing line not responsible for absence of stencil

The Chicago, Burlington & Quincy cleaned the air brakes under A. C. L. car 25088 February 13, 1923. On September 26, 1923 the Atlanta, Birmingham & Atlantic cleaned the air brakes on this same car, showing as the reason that no date or road of last cleaning was stenciled on the car. The A. C. L. upon receipt of the billing repair card of the A. B. & A., used that card as joint evidence against the C. B. & Q. that it did not properly stencil this car when the brakes were cleaned on February 13, 1923. The C. B. & Q. declined to accept responsibility for failure to stencil air brakes, not conceding as conclusive evidence the A. B. & A. repair card. The C. B. & Q. claimed that it was highly improbable if not impossible that a car could pass through numerous interchange and inspection points for seven months without the absence of stencil marks being detected.

The Arbitration Committee in rendering its decision sustained the bill of the Chicago, Burlington & Quincy, drawing attention to the decision in Case 1441 as applicable to this case.—*Case 1442—Atlantic Coast Line vs Chicago, Burlington & Quincy.*

Expense of cleaning tank properly included in transfer cost

The Texas & Pacific delivered to the Vicksburg, Shreveport & Pacific, I. & G. N. tank No. 10803 loaded with 10,000 gal. of gas oil and distillate and issued transfer authority on account of the tank leaking. The V. S. & P. transferred the contents into UTLX tank No. 76222 and when rendering a bill against the T. & P. included an item of $21.17, which amount they claimed they agreed to pay the Shreveport Refining Company for cleaning out UTLX tank No. 76222 after being returned empty. The V. S. & P. claimed that the cost of cleaning out the tank was properly chargeable against the T. & P. on their transfer authority. The T. & P. contended that their transfer authority authorizes a bill for labor and material expense only for transferring the

contents plus 10 per cent for supervision, and declined to accept the charge for $21.17. In the statement issued by the V. S. & P., it was claimed that after I. & G. N. tank 10803 had been held for several days trying to locate a suitable car UTLX tank 76222 was finally secured on the understanding that when this car was returned to its owner it would be cleaned and put in its original condition. The owners would not consent to the use of the car except under these conditions. The V. S. & P. contended that it is the intent of Car Service Rule 14 that the delivering line under these conditions should pay the entire cost incurred by the receiving line in such a transfer and that the cost of cleaning the car is properly a part of such cost.

The Arbitration Committee in its decision stated that, in this situation, the expense of cleaning the tank is properly included in the cost of transfer. A note included in this decision states that this decision has been approved by the General Committee of the Transportation Division, American Railway Association.—*Case No. 1440—Texas & Pacific vs. Vicksburg, Shreveport & Pacific.*

Responsibility for cost adjusting lading

The Georgia & Florida's chief car inspector at Augusta, Ga., wrote the Charleston & Western Carolina a letter quoting instructions from the superintendent car service of the former road requesting the C. & W. C. to discontinue the issue of transfer authority cards covering carloads of lumber claimed improperly loaded under A. R. A. rules. The notice also requested that when improperly loaded cars of lumber were received by the C. & W. C. in interchange, they should be returned to the G. & F. with advice as to the defects or irregularities in loading so that the G. & F. could make their own transfers or adjustments of lading. The C. & W. C. replied that they would not accept the notice of the G. & F. as authority to make any change in the manner of handling interchange movements at Augusta, stating in a later communication that they would continue to handle the interchange according to A. R. A. rules and would not go to the expense and delay of backward movement of freight except in so far as might be required by the rules. New York Central car 345653 was delivered to the C. & W. C. by the G. & F. March 2, 1925, loaded with lumber, the lading not complying with loading rules. The C. & W. C. requested the G. & F. to furnish adjustment authority in accordance with A. R. A. Interchange Rule 2 and Car Service Rule 14 which the G. & F. refused to furnish. The C. & W. C. in its statement of facts mentioned that the contents in question which did not comply with the loading rules could and should have been seen by the G. & F. car inspector while the car was in that road's possession and that the lading should have been corrected before offering the car to the C. & W. C. The C. & W. C. further contended that the fact that the G. & F. delivered the car in such condition in interchange was ample notice that the G. & F. did not have any intention or desire to prepare the load so as to conform to the A. R. A. Loading Rules requirements and that the receiving line should not be penalized by being required to back haul a car that is improperly loaded when delivered.

The Arbitration Committee in rendering its decision sustained the contention of the Charleston & Western Carolina and stated that the Georgia & Florida was responsible for the cost of adjusting the lading.—*Case 1443—Charleston & Western Carolina vs. Georgia & Florida.*

Handling line responsible for car damaged in derailment

The Central Railroad of New Jersey under date of April 6, 1925, notified the Soo Line that its car No. 131572 had been seriously damaged when a train parted on account of drawbar straps breaking on the second car from the caboose. The Soo Line car in question was the thirty-fourth car from the caboose and was loaded with zinc ore. After the damage occurred to the car one truck was derailed, not causing the accident, but resulting from it. The Minneapolis, St. Paul & Sault Ste. Marie stated that the notice received from the Central Railroad of New Jersey requesting disposition under Rule No. 120, was not accompanied by an inspection certificate nor was there any explanation as to how the damage occurred. A report on a subsequent investigation revealed that the car was involved in derailment in connection with the accident which caused the damage. The Arbitration Committee in rendering its decision ruled that as the car was derailed the handling line was responsible and that the decision in Case No. 1179 is applicable to this case.—*Case No. 1444—Central Railroad of New Jersey vs. the Minneapolis, St. Paul & Sault Ste. Marie.*

Charges for substitution of triple valves

The Atchison, Topeka & Santa Fe entered repair bills against the Southern Pacific Company—Pacific System covering charges for an exchange of triple valves on Southern Pacific cars No. 34233 and No. 22879 at San Bernardino, Cal., April 20 and May 7, 1924, respectively. In each of these cases New York H-1 triple valves were removed and K-2 triple valves applied, the cars having previously been stenciled for K-2 valves while the dates on which the cars were built as revealed by the repair cards were May, 1909, and January, 1913, respectively. In each case a net charge of $30.50 was made covering the price of the new triple valves in accordance with Item 57 of Rule 101, which was $31.50 less scrap credit of $1.00 for the New York H-1 valve removed. In addition a charge of $4.14 was made in each case for cleaning, oiling, stenciling and testing the air brakes. The Southern Pacific contended that because of the fact that these cars were built prior to January 1, 1915, the maximum charge that could properly be made is $11.30 plus the regulation charge for cleaning, oiling, testing and stenciling. The A. T. & S. F. maintained that its charges were entirely proper regardless of the fact that the cars were built prior to January 1, 1915, in view of the fact that the cars were previously stenciled for K-2 triples and further maintaining that had K-2 triples not been applied in each of these cases, wrong repairs would have been perpetuated.

The Arbitration Committee rendered a decision to the effect that since both cars were previously stenciled for K-2 triple valve, the contention of the A. T. & S. F. is sustained.—*Case No. 1445—Southern Pacific vs. Atchison, Topeka & Santa Fe.*

Owner's defects cause removal of all wheels on car at the same time

On February 16, 1925, the Great Northern changed all the wheels on UOCX car No. 664 and gave as reasons for the removal the following: Wheels R & L 1, both shelled out. Wheels R & L 2, both shelled out. Wheels R & L 3, one shelled out and one worn through chill. Wheels R & L 4, one sharp flange and one worn

through chill. The Union Oil Company questioned the removal of these wheels because of the fact that this was the only case having come to its attention where the entire set of wheels on one car was removed at the same time for various reasons (except slid flat), stating that it did not believe it possible that the entire set of wheels would fail at the same time. The statement of facts by the Great Northern brought forth the information that while cases of this kind were rather uncommon, they are by no means inconceivable nor are they exceedingly remote; that several cases had come to the attention of that road where its own equipment had been subjected to similar repairs.

The Arbitration Committee, after conducting an investigation which failed to develop that any of the defects were incorrectly reported, rendered a decision in which the contention of the Great Northern was sustained.—*Case* 1446—*Union Oil Company vs. Great Northern.*

A simple safety device for holding the blue flag

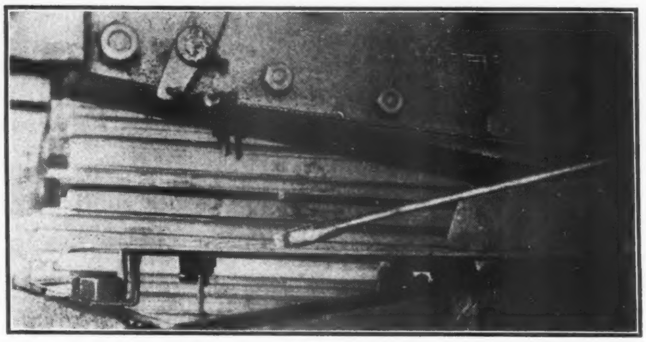
By Joseph C. Coyle

CAR repair men usually feel more comfortable when they are certain that the blue flag is standing erect at the entrance to the track on which they are working. An all-metal flag, however, is heavy and is apt to fall down when stuck carelessly in soft earth or frozen ground. This possibly can be eliminated by sinking a piece of iron pipe in the ground at the entrance to each repair track, as shown in the illustration. This provides a firm socket for the flag.

An iron pipe sunk in the ground provides a firm socket for the blue flag

Handy gage for power shear

A SHEET metal length gage designed in the steel car shop of the D. & R. G. W., Denver, Col., has been found useful in cutting material on the shearing machine. It is made of an 18-in. by 26-in. steel sheet, ½ in. thick. Near each edge are two slots running the greater part of its length. These slots allow for the adjustment, by means of two ¾-in. bolts, of the 18-in. angle iron which is used to gage the length to be cut. The front end of the gage is fastened down by a bolt, which passes through a light piece of metal welded to the under side of the sheet. The back end is secured by a narrow bar, also welded to the under side of the sheet and bent at each end to fit under a bolt on each side of the head of the machine, as shown in the illustration.



A simple shear length gage

A convenient rivet snap holder

ONE of the greatest difficulties that a riveter has in the railroad shops is transporting his collection of snaps for his "gun," from job to job and gathering them up off the shop floor when he wants to move. The carrier, shown in the illustration, which is used at the Denver shops of the Denver & Rio Grande Western has proved useful in eliminating this trouble. It is made from a sheet of ½-in. by 12-in. steel with legs of the same material 6 in. in length welded to the bottom, and a short rod for a handle welded on the top. Twelve holes, of proper dimensions to hold the assortment of snaps, are punched in the plate. Thus, a full complement of snaps is always ready for the riveter and may be moved at an instant's notice.

Rivet sets are kept together in a carrier rack

Safety work featured at Sacramento Shops

PARTICULAR emphasis is placed on safety work at the Southern Pacific shops at Sacramento, Calif. General safety meetings are held once a month, presided over by the superintendent of motive power attended by safety committee members representing the various shop crafts, certain foremen and apprentices who are invited to attend, and other employees. After a brief reading of the accident reports of the preceding month, the meeting is thrown open for discussion and an attempt made to analyze each accident for its cause in accordance with the table.

Analysis of causes of carelessness

Type	Remedies
A—Apparent carelessness, caused by	
1—Ignorance (ordinary)	1—Instruction
2—Man not sufficiently instructed	
3—Work too heavy for the man	
4—Man too green on job	
5—Using wrong tools	
6—Tools in bad condition	
7—Using tool incorrectly	
8—Defective equipment	
9—Equipment not handled correctly	
10—Dangerous procedure permitted	
B—True carelessness (temporary), caused by	
1—Work routine; performed mechanically	1—Shock
2—Man gets excited or rattled	2—Transfer to other job
3—Man too familiar with the job	3—Try first to determine cause and try to interest the man
4—Mental strain	
5—Man in too much of a hurry	
6—Man not interested in the job	
7—Man not following directions	
8—Poor judgment	
C—True carelessness (permanent), caused by	
1—Taking foolish chances continuously	1—Man dismisses himself
2—Man does not care	2—Discharge him
3—Disobedience	
4—Poor judgment	

This method has brought out considerable information which would not otherwise have been obtained. In a typical meeting, attended by 18 safety committee members and 25 visitors, 20 accidents were discussed in detail and suggestions made as to how each could have been prevented. In addition, one of the members presented a paper prepared for the occasion.

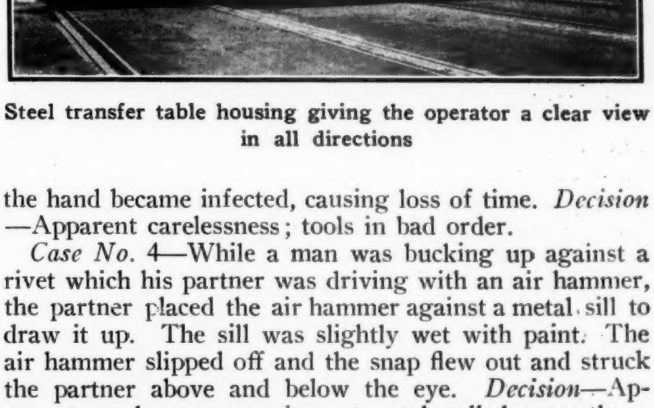
Typical cases

A few examples of the cases considered are as follows:

Case No. 1—A painter on a rush job on a locomotive tender was working on a scaffold. In his rush to complete the job and through total absorption in the work he backed off the end of the scaffold. *Decision*—True carelessness; temporary type.

Case No. 2—A workman used burning waste to start a gas burning heater. The heater did not light as soon as expected, so he leaned over it to find out the reason. The gas ignited, burning his face. *Decision*—True carelessness; permanent type.

Case No. 3—While a man was using a wrench on a machine the wrench slipped, causing a slight abrasion of the hand, which he did not report. After several days,



Steel transfer table housing giving the operator a clear view in all directions

the hand became infected, causing loss of time. *Decision*—Apparent carelessness; tools in bad order.

Case No. 4—While a man was bucking up against a rivet which his partner was driving with an air hammer, the partner placed the air hammer against a metal sill to draw it up. The sill was slightly wet with paint. The air hammer slipped off and the snap flew out and struck the partner above and below the eye. *Decision*—Apparent carelessness; equipment not handled correctly.

Case No. 5—An electric welder working in the erecting shop failed to use the proper shields furnished him to prevent other workmen from being affected by flashes.

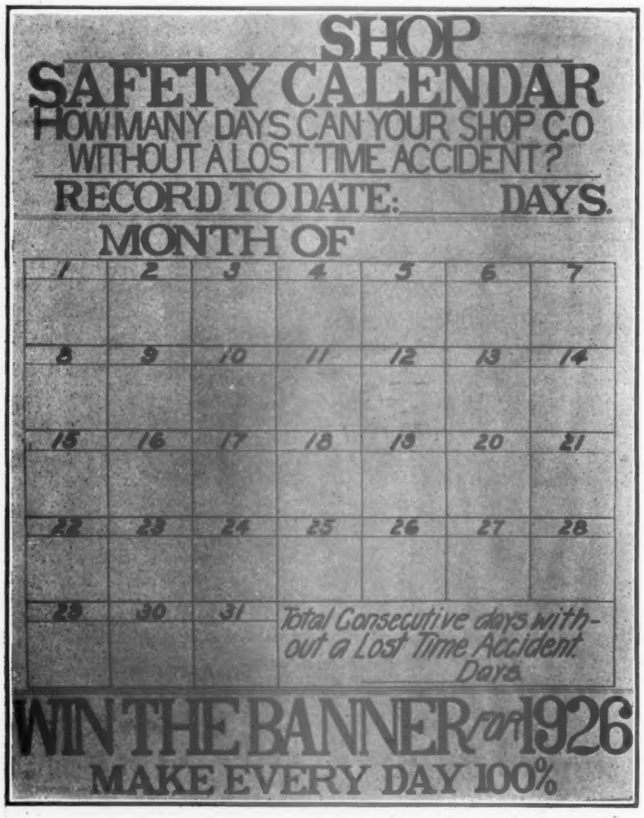
A man working nearby was badly flashed. *Decision*—Apparent carelessness; equipment not handled correctly.

Case No. 6—A man dropped a cold journal brass into a pot of molten metal, causing the metal to fly and strike him in the eyes, even though he was wearing goggles. *Decision*—Temporary carelessness; the man was in too much of a hurry and not instructed as to danger from such a practice.

Case No. 7.—A man was washing the windows in the shop and placed his hand against the window pane to shift the ladder. In doing so, the glass gave way, cutting his hand severely. *Decision*—Permanent carelessness; taking foolish chances.

Case No. 8—A man working on a lathe kicked turnings from under his feet. A turning, having a sharp edge cut his foot, necessitating the taking of five stitches to close the wound. *Decision*—True carelessness; poor judgment; temporary type.

Case No. 9—A man knocked out the pin supporting one end of an eccentric rod which permitted the rod to



A shop safety calendar which has stimulated much interest

drop suddenly, mashing a finger. *Decision*—True carelessness; temporary type; poor judgment.

Case No. 10—Two men were handling a four-inch pipe with a bend on one end, on a hand truck. The man on the straight end of the pipe let go his end, permitting the pipe to turn so that the bent end struck the other man on the foot. *Decision*—Apparent carelessness; should have used proper equipment to handle such work.

Case No. 11—A man reached across the band saw table to knock off scrap lying on the table and in some way his hand came in contact with the saw, cutting the back of his hand. *Decision*—True carelessness; temporary type; mind not on work.

Case No. 12—A man was cutting off rivets without using a catcher, when he had been instructed to do so. The rivet flew, striking another man working on the job and causing a slight abrasion of the scalp. *Decision*—True carelessness; permanent type; workman cutting rivets did not care.

Case No. 13—A springmaker knocked a block from the table when removing a spring, which dropped on his foot, bruising the big toe. *Decision*—Apparent carelessness; defective equipment; has been remedied so the same accident cannot occur again.

Suggestions are welcomed from all employees at Sacramento shops regarding conditions in or about the shop which should be corrected to avoid possible accidents. These recommendations are considered by the committee and a report made of the name of the employee, the change suggested, and the action taken, whether favorable, unfavorable, or referred to the general safety committee. Each member of the safety committee reports on the number of men to whom he has talked personally regarding safety subjects during the month. In the month mentioned, for example, 161 men were thus approached and made to feel that the safety committee and their foremen are all personally and vitally interested in the prevention of accidents.

A safety calendar such as is shown in one of the illustrations is posted in each shop on the bulletin board and has served effectively to stimulate interest. The shop clerk makes an entry of the class of each accident on the day the accident occurs; a clear calendar means a 100 per cent record in accident prevention for that particular department. The interest in keeping this Calendar clear has been such that a man whose carelessness is responsible for an accident and who consequently spoils the record for the month, is subject to considerable adverse comment on the part of his co-workers. These calendars are returned to the office and form the basis of shop reports, one of which in a typical month, is shown in the table.

Locomotive shop safety ratings—November 1, 1926.

Shop	Accidents classes 1	2	3	Points lost	Safety this month	Rating last month	Consecutive days without a lost time accident	Best previous record-days
Electric shop	0	0	0	0	100	100	92	..
Pattern shop	0	0	0	0	100	100	92	..
Locomotive paint	0	0	0	0	100	100	92	..
Tool room	0	0	0	0	100	100	92	..
Air brake	0	0	0	0	100	100	92	..
Bolt shop	0	0	0	0	100	100	92	..
Reclamation shop	0	0	0	0	100	100	92	..
Spring shop	0	0	0	0	100	100	92	..
Iron foundry	0	0	0	0	100	99	92	..
Tender shop	0	0	0	0	100	98	92	..
Copper shop	1	0	0	1	99	100	92	..
Pipe shop	1	0	0	1	99	100	92	..
Rolling mill	1	0	0	1	99	100	92	..
Frog shop	1	0	0	1	99	100	92	..
Blacksmith shop	1	0	0	1	99	99	92	..
Steel foundry	1	0	0	1	99	98	83	52
Forge shop	2	0	0	2	98	100	92	..
Brass foundry	0	1	0	2	98	99	92	..
Erecting shop	4	0	0	4	96	99	83	52
Drop pit	0	0	1	5	95	100	11	81
Boiler shop	1	0	1	6	94	91	10	38
Car repair force	1	0	1	6	94	100	..	..
Machine shop	10	0	0	10	90	86	31	19
Tank shop	1	0	3	16	84	100	6	75

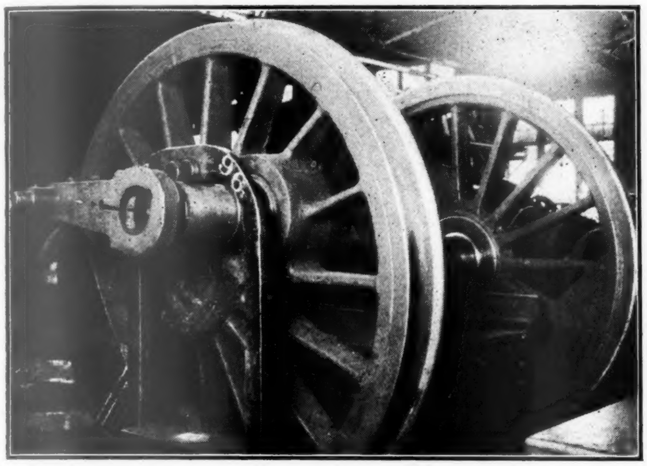
In this table the shop department which has had no accident during the month is credited with 100 points. For a Class 1 accident, involving no lost time, the penalty is one point; for a Class 2 accident, involving a loss of less than three days, the penalty is two points; for a Class 3 accident, involving a loss of three days or over, the penalty is three points.

The method of enclosing the transfer table at Sacramento shops with a steel housing in the interests of safety is illustrated. It will be noticed that the entire pit is filled in to the normal track level, which is not only a good safety feature, but facilitates handling material across the pit. A steel housing prevents anything from getting under the transfer table or wheels as the table traverses its track. Moreover, the new steel cab for the

operator is not only neat and attractive, but has windows giving a clear view in all directions, an important improvement over the old wooden structure.

Counterbalancing yoke

THE details of a yoke successfully used for counterbalancing locomotive driving wheels at the Louisville & Nashville shops, South Louisville, Ky., are shown

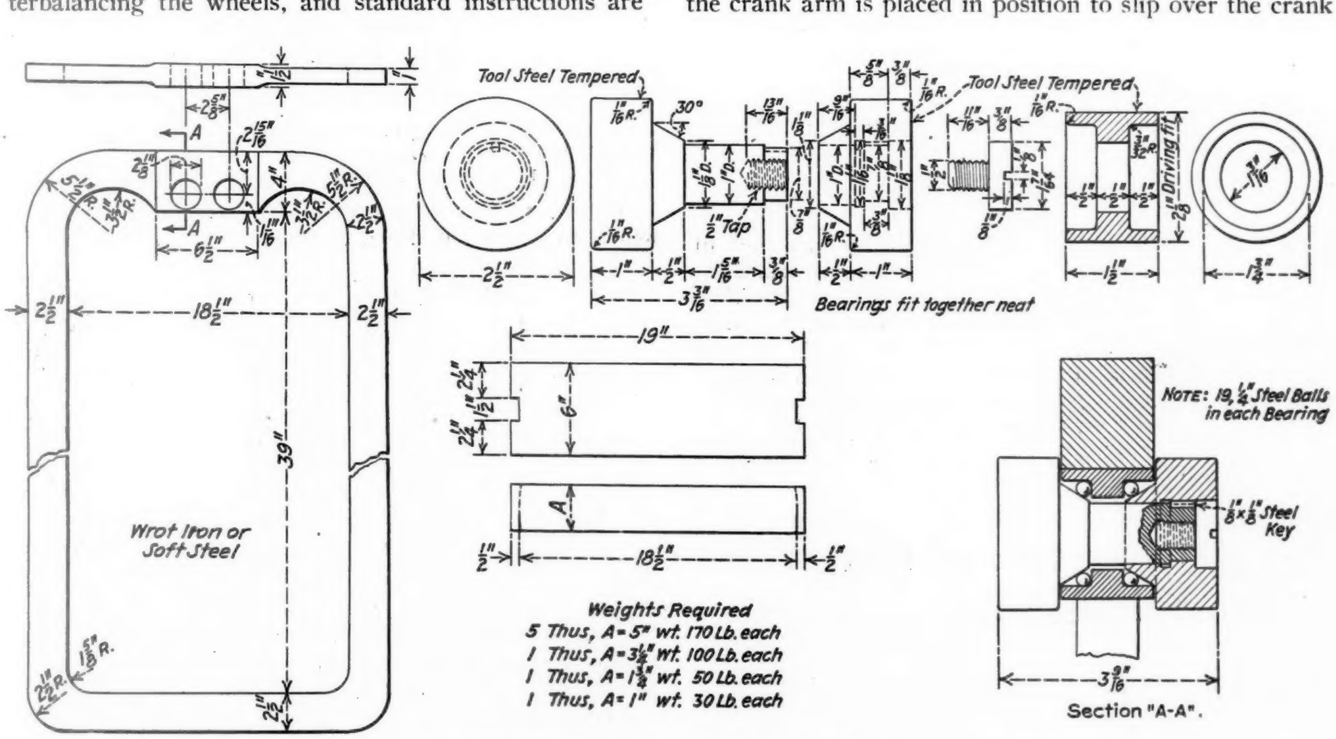


Roller and ball-bearing counterbalance yoke suspended from main crank pin

in the drawing and the method of using yoke in the photograph. A great deal of care is exercised in counterbalancing the wheels, and standard instructions are enforced which assure the accurate balance of the revolving weights on each pin.

The counterbalance yoke is made of 1-in. by 2½-in. steel forged as shown, and includes at the top two rolls supported on ball bearings which minimize the frictions as the driving wheels turn and the rolls supporting the yoke revolve. There are nineteen ¾-in. steel balls in each bearing and just the right amount of play can be obtained in the ball bearings by proper adjustment of the holding screw.

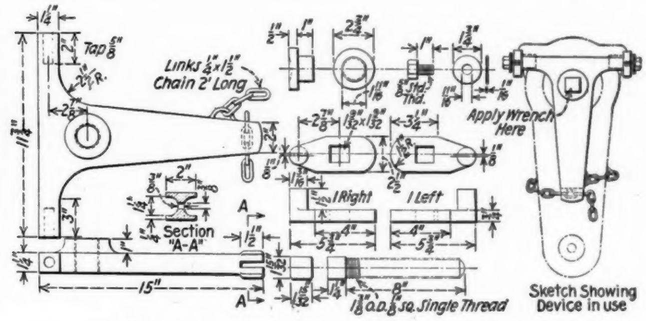
Eight weights are required as shown in the drawing, the construction being such that they can be readily applied to or removed from the yoke. They vary from 1-in. to 5-in. thickness and from 30 lb. to 150 lb. in weight.



Ycke for counterbalancing driving wheels

Device for applying and removing eccentric crank arms

THE two devices shown in the drawing are used, one for applying and the other for removing eccentric crank arms. These two devices were developed by



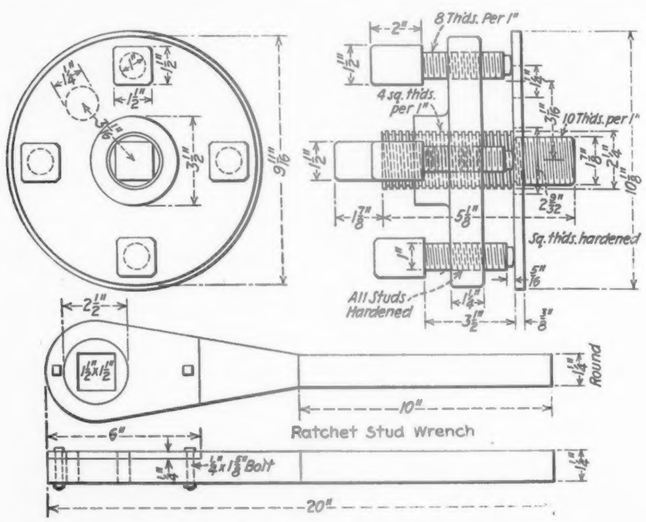
Device for removing eccentric crank arms

employees of the Lehigh Valley shops, Sayre, Pa.

To use the devise for applying eccentric crank arms, the crank arm is placed in position to slip over the crank pin. The center screw of the device is then screwed into the crank pin grease plug hole so that the ⅜-in. plate rests firmly against the side of the crank arm. The 2 9/32-in. hole in the center of the plate permits free movement of the plate over the 2¼-in. square-thread, case hardened stud. This stud screws through a plate,

as shown in the drawing, which is also provided with four 1-in. studs, the ends of which bear against the surface of the ⅜-in. plate. All five studs have 1½-in. square heads to which the ratchet stud wrench, the principal dimensions of which are shown at the bottom of the drawing, can be applied. The eccentric arm is forced on the crank pin by turning the four outside studs with a ratchet wrench. This is an improvement over the old method which requires clamps to pull the main rod clear of the crank arm and considerable time was often lost waiting for this work.

The device for removing eccentric crank arms consists essentially of a frame to one end of which is secured a chain which fastens around the arm of the eccentric crank as shown at the right of the drawing. The large end of the frame is designed so that two finger clamps are placed in line with the bolt holes in the end of the eccentric crank. These clamps slide into the bolt holes and hold the end of the crank as shown. A square threaded 1⅜-in. screw is inserted through the solid center of the frame of the device. The end of this screw



Device for applying eccentric crank arms

bears against a plug which fits into the grease hole of the crank pin. The screw is forced against the crank pin by turning the screw with the ratchet wrench described in the preceding paragraph. The chain and clamps pull the eccentric crank off the crank pin.

The old method of doing this job consisted of wedging open the eccentric arm and then proceeding to wedge it off the crank pin. This method invariably scarred and often cracked the eccentric arm and was often a cause of poor fits.

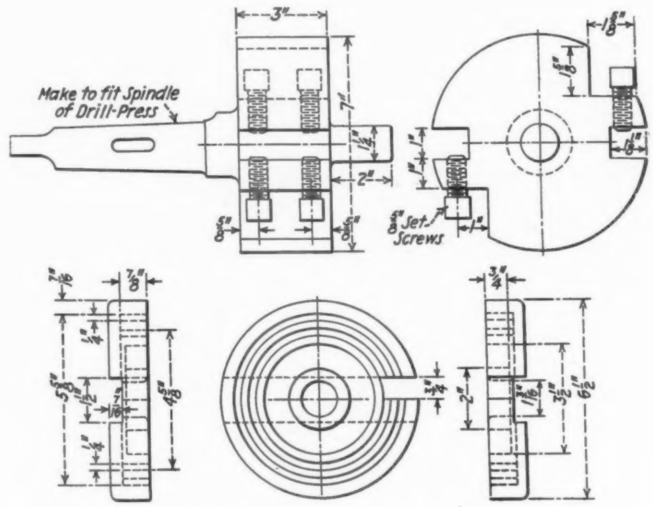
Gage for setting blades in superheater flue cutters

By J. Robert Phelps

Apprentice instructor, A. T. & S. F., San Bernardino, Cal.

The illustration shows a gage used for setting the blades in a superheater flue cutter so that they will have the right clearance and cut the right diameter. The grooves in the gage are cut the exact diameter to which the superheater flue holes are to be cut in the flue sheet. The hole in the center of the gage is the same diameter as the pilot on the flue hole cutter. To set the blades in the proper position, the gage is slipped over the pilot of the tool holder and then the blades are set in the proper position. After the correct clearance is obtained the blades are drawn up tight.

With this arrangement there is no guess work and no trial and error. The blades are set to the gage and they

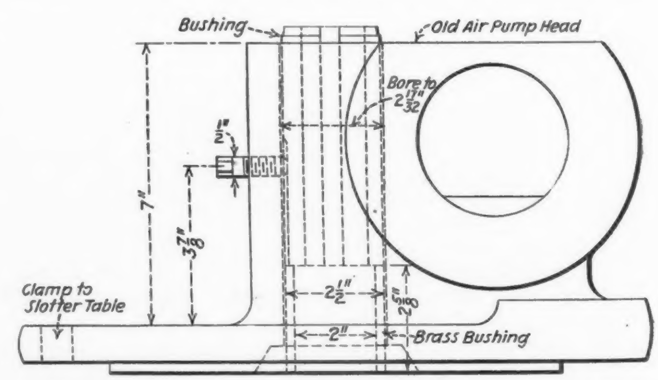


By means of this gage the blades in a superheater flue hole cutter can be set to the correct clearance and to cut the right size hole

cut a smooth hole to the right diameter. This arrangement makes it an easy matter to have a few extra blades on hand and ground ready to apply when needed.

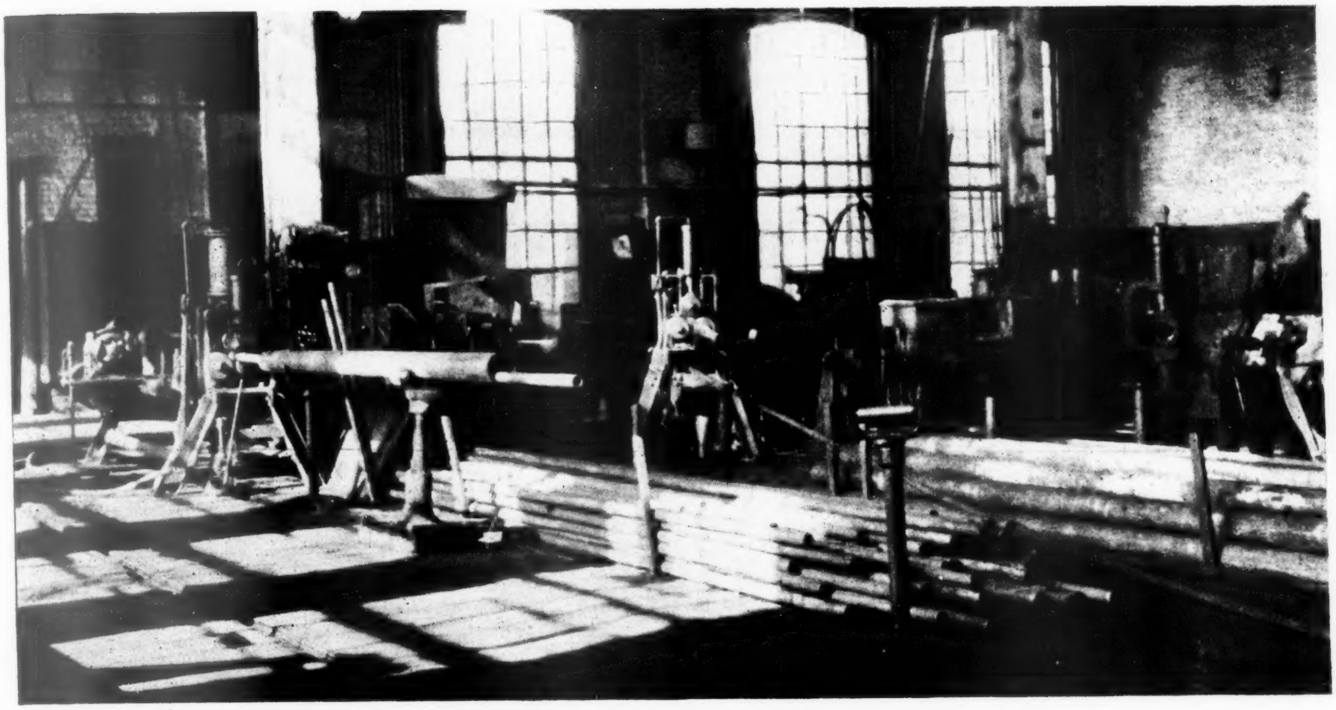
Machining reversing valve chamber bushings

The jig for machining reversing valve chamber bushings on Westinghouse air compressors, shown in the sketch, was developed by one of the employees of the shops of the Lehigh Valley at Sayre, Pa. It is made from an old 9½-in. air compressor head, the top of which has been cut down to permit the bushing to ex-



Jig for machining reversing valve chamber bushings on a slotter

tend clear. A hole is drilled and tapped in the side of the reversing valve chamber for a ½-in. set screw. The air compressor head is clamped to the table of a slotter; the bushings to be machined are placed in the reversing valve chamber, as shown in the sketch, and clamped in position with the set screw. Three bushings per hour was the average production by the old method, while with this jig a first year apprentice can turn out 14 per hour. The cost of this jig did not exceed 60 cents.

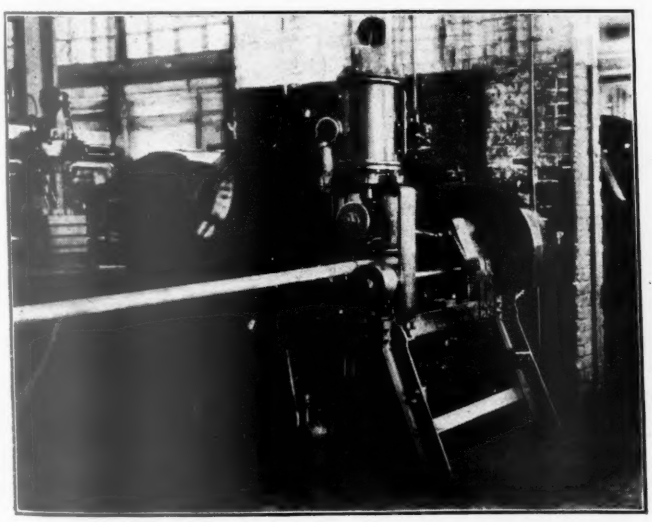


General view of the Boston & Albany, West Springfield flue shop

Repairing flues at B. & A. West Springfield shops

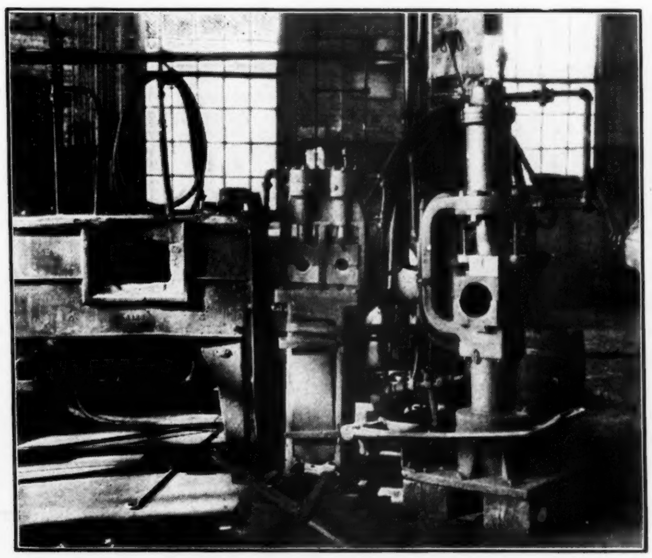
Modern equipment reduces cost and shop force—Monthly output averages 5,000 flues and 550 tubes

THE locomotive repair shop of the Boston & Albany at West Springfield, Mass., contains 19 locomotive repair pits from which are turned out every month an average of 19 classified repairs. The locomotives repaired at this point are from two divisions,



This machine is used to cut the flues to the proper length after safe-ending

namely: The Boston division, which extends from Boston, Mass., to Springfield, and from the Albany Division, which extends from Springfield to Albany, N. Y. The water used on the Boston division contains considerable



The oil furnace and the two swedging machines

lime which forms a soft brown scale that is easily removed. The water used on the Albany division forms a hard white scale more difficult to remove.

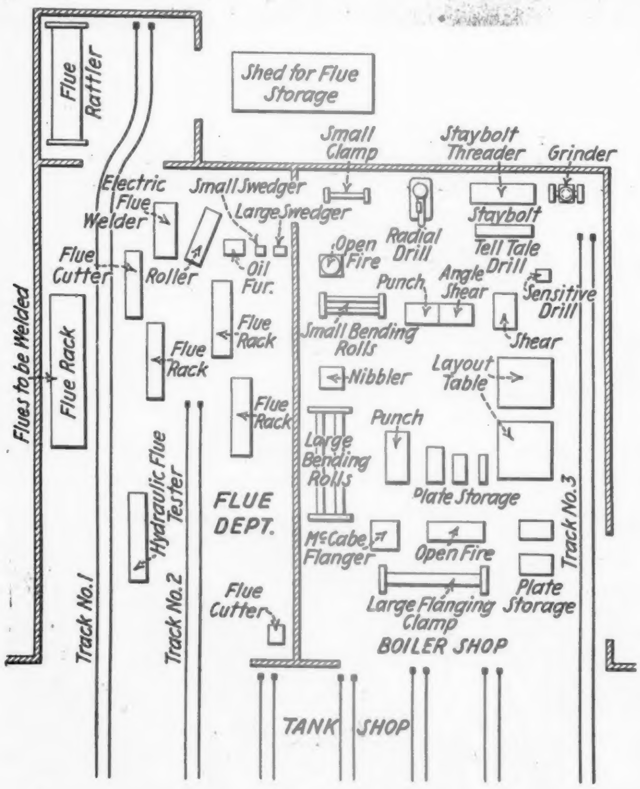
The flue shop at West Springfield repairs approxi-

mately 5,000 small flues and 550 superheater tubes every month. Until about two years ago, this shop was equipped to safe-end the flues by the oil furnace method. This method was not entirely satisfactory for several reasons: First, owing to the excessive heat of the furnaces, the labor turnover was high; second, the percentage of flue failures while undergoing the hydrostatic test was excessively high; third, it was felt that the cost per flue was considerably higher than it should be.

It was decided to change from the oil furnace welding method to the electric welding method. This necessitated a complete change of flue shop machinery. The following table shows the present equipment as compared with the retired equipment.

Present equipment	Retired equipment
Flue cutter	Flue welder
Electric flue welder	Oil furnace
Flue roller	Universal flue welder
Oil furnace	Pneumatic welder
Small swedger	Flue welding oil furnace
Large swedger	Flue welding oil furnace
Flue tester	Hot saw and tube expander
Flue cutter	Hot saw and tube expander
Flue rattler	
Four flue racks	

The relative location of the present equipment may be determined from the shop layout shown in one of the



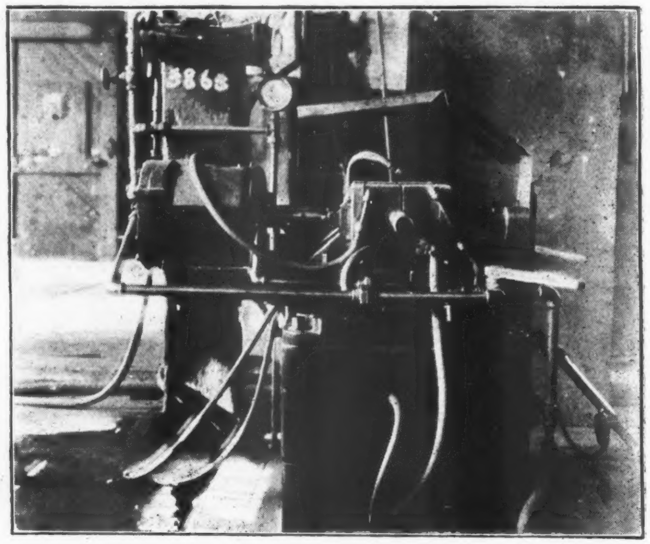
Arrangement of the equipment in the flue and boiler shops

illustrations. It should be noticed that in the list of retired equipment are three oil furnaces while only one is used at the present time. The retirement of two oil furnaces has improved the working conditions in the shop.

As a result of this change of machinery the labor turnover has been reduced to practically zero, the shop force has been reduced from nine to five men, the percentage of flue failures under hydrostatic test has been reduced and the cost has been reduced approximately four cents per flue.

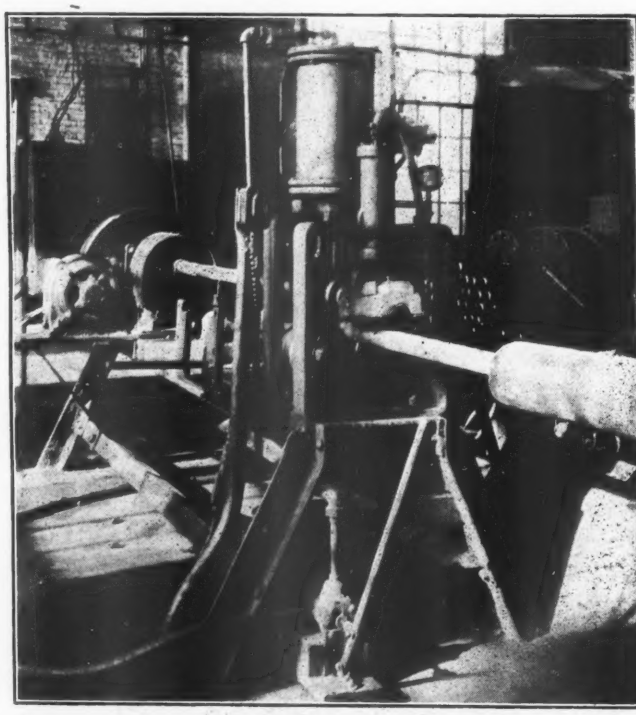
Method of handling the flues

Referring to the layout of the flue shop, the flues are taken on shop track No. 1 to the flue rattler which is located in a small building adjacent to the northeast end of the shop. The flue rattler is of the revolving drum water type. To insure that the flues are cleaned properly, the drum is not overloaded. The flues remain in the rattler for 30 min. The flues are then sent back along track No. 1 and placed on the rack near the flue cutter.



The electric butt flue welder which safe-ends both large and small flues

After the ends have been cut off the flues are placed in the rack directly opposite the electric flue welder. The flues are now ready for safe ending. The safe ends are cut from new flues. When the butt weld is made the flue is immediately pulled out of the electric welder and

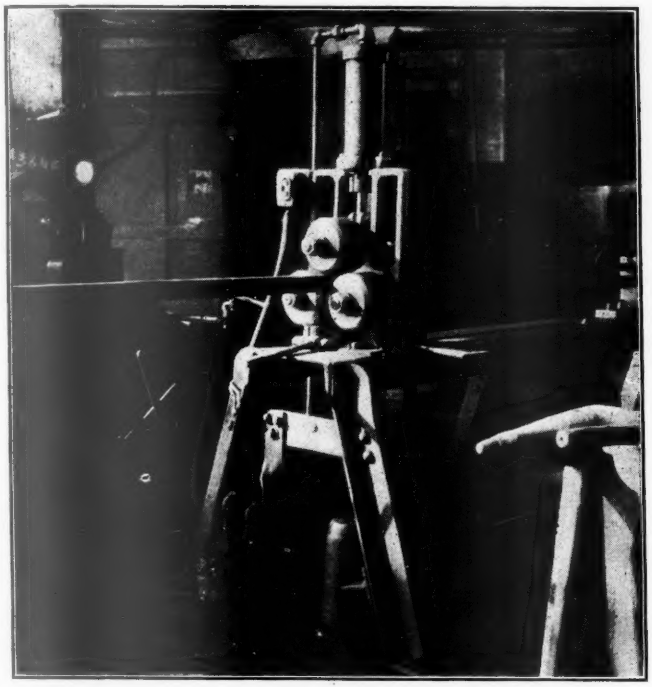


A motor driven flue cutter

placed in the flue roller next to it, where the weld is rolled smooth. The flues are then placed in the rack opposite the oil furnace. They are now ready for the swedging operation. The flues are taken from the rack in groups of four or five, depending on their size, brought to a working heat and swedged down in one of the two

swedgers, depending on the size of the flues. This heating tends to anneal the steel safe ends of the flues, which is very desirable and necessary as it makes for easier and better working when the flues are being installed in the boiler. This operation completed, the flues are placed in the rack to the right of shop track No. 2, from which they are taken to the flue cutter at the southwest end of the shop where they are cut to the proper length.

The flues, now completely finished, are taken to the hydraulic flue tester where the welds are subjected to a water pressure 50 per cent greater than the working



Internal and external roller type of flue welder used in the flue shop

steam pressure. When the flues are put in the boiler, the new safe end is placed in the back flue sheet as the new material when beaded and welded gives a much better job.

Since the advent of the new process for safe ending the flues, only one flue has had to be removed from the locomotive after the hydrostatic test.

Tool holder used on journal turning lathe

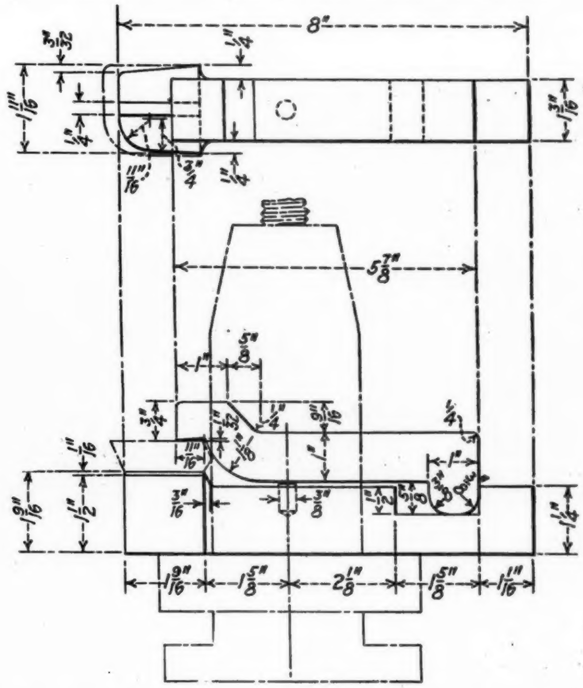
By Claude Watson

Department foreman, C. & E. I., Danville, Ill.

THE tool holder shown in the drawing utilizes all of the scrap tools that are discarded or worn out from usage on the Davis car wheel boring bar. In this manner, maximum service is obtained from these tools, thereby effecting a substantial saving in the purchase of 1¼-in. by 3-in. by 12-in. tool steel. The fact that one man turns the journals on an average of 20 pairs of wheels every eight-hour day, will give some idea as to the amount of tool steel saved by utilizing the worn tools discarded by the operators of the car wheel boring machine.

This tool holder can also be used for the turning of journals on any axle lathe. If the machine is old and chatters, then reduce the width of the tool to suit.

It should be noted that the top section has a 1/32-in. taper on the bottom side where it fits down against the tool and also a dowel pin in the bottom section so that



Tool holder for using the scrap ends of Davis boring bar tools on a journal turning lathe

the set screw can be screwed down only tight enough to maintain a firm hold on the tool and still not bend out of shape or break the top part of the holder. There is no way that the tool can slip or get out of shape. The journals of 19 pairs of wheels have been turned without grinding the tools.

Attachment for turning tumbling shaft bearings

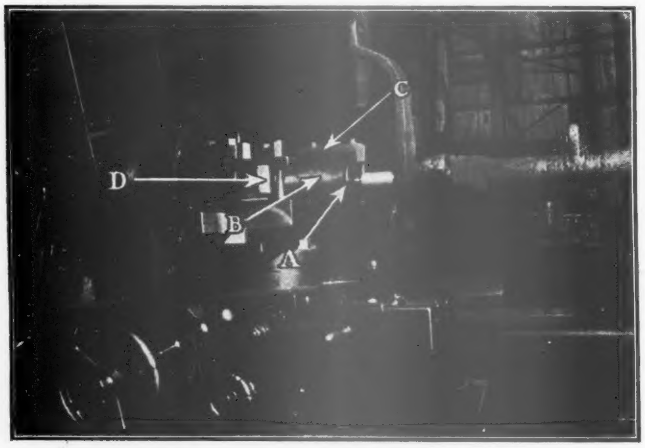
By H. H. Henson

Machine shop foreman, Southern, Chattanooga, Tenn.

ORDINARILY it requires a 60-in. lathe or larger to hold between its centers the different sizes and lengths of tumbling shafts common to modern locomotives. The illustration shows a view of an attachment which can be used on any size engine lathe for turning the largest or the smallest tumbling shaft bearings in 30 min.

The attachment consists of four working parts. Referring to the illustration, *A* is a cylinder 12 in. long and 6 in. in diameter with a hole drilled in one end through which extends a lathe center in which one end of the tumbling shaft fits. The opposite end of the cylinder is bored and threaded to screw on the lathe spindle which drives the device. This end of the cylinder also contains several ½-in. holes into which fit the prongs of a spanner wrench. A key 14 in. long by ¼ in. by ½ in. is located on the cylinder. The cast iron sleeve *B*, which is bored to a close sliding fit over the cylinder, contains a keyway which fits over the key on the cylinder. The cutting tool bar *C* holds the 7/16-in. square tool bit. The tool bars are made in different lengths and shapes for different sizes of tumbling shafts. The bars are fastened on the sleeve *B* by two ½-in. cap screws. A slot 3/16 in. deep by 1½ in. wide is planned lengthwise in the sleeve. The

tool bar fits in this slot which provides a rigid support and eliminates tool chatter. The opposite end of the sleeve has cut in it a slot 1 in. wide by ¾ in. deep, into which fits the fork *D*. This fork is made to fit one-half of the slot or recess cut in the sleeve. The fork is made



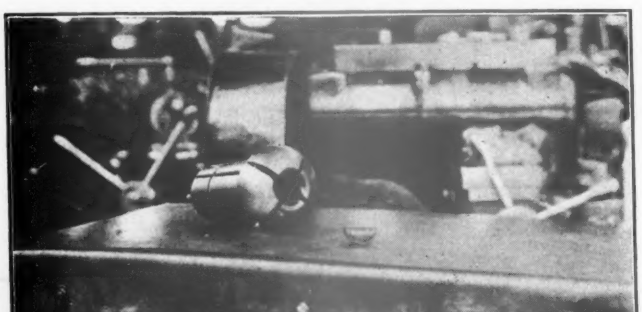
Attachment for turning tumbling shaft bearings between centers on any engine lathe

long enough to fit in to the tool post as shown in the illustration.

The tool bit is properly set, the lathe started, the spindle revolving the cylinder *A*; the carriage feed is placed in operation and the fork *D*, moves the sleeve *B* over the cylinder thus feeding the tool across the tumbling shaft bearing.

Useful device for turning radial staybolts

IN the machine shop of the Union Pacific at Denver, Colo., considerable trouble was experienced in holding in the turret lathe chucks the irregular sized heads of radial staybolts. Thus, when turning and threading these bolts, it was necessary to adjust the chuck jaws for the majority of the bolts machined which, in the aggregate, required considerable time. The device shown



This device facilitates chucking radial staybolts in turret lathes

in the illustration was made to overcome this trouble. The device, which is 6 in. long, was first turned in one piece to a size which would just fit in the chuck jaws of the turret lathe. It was then cut into four equal sectors. A rounded head, with a square shoulder at the back, extends 1¼ in. from the end. A small coil spring band, which fits into a groove encircling the device near the back end, and four short coiled springs in the head, inserted like dowel pins in pockets between the sectors, hold them together and make them adjustable to the varying sizes of the bolt heads.

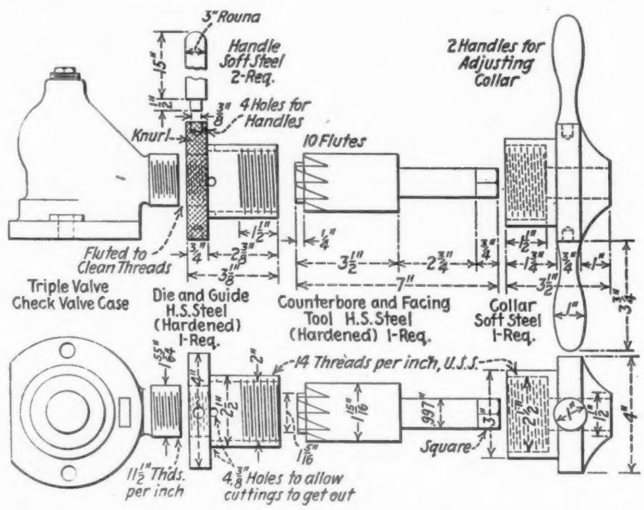
At the back end of the device a circular plate, ½ in. thick, holds the sections together by means of four ½-in. set screws. Each section has a groove inside the head end in which is inserted a ¾-in. by 1½-in. notched jaw, shaped like a Woodruff key, to grip the bolts.

Triple check valve refacing tool

By William Haynes

Air brake foreman, Missouri Pacific, Kansas City, Mo.

THE three-in-one tool, the details of which are shown in the accompanying drawing, has proved convenient in the repairing of triple valve check valve casings which have become slightly damaged by being dropped or handled in such a manner as to cause pieces to be broken out at the union seat. Ordinarily, if repaired by hand, it would be necessary to file or grind these broken spots out in order to renew the surface and provide a joint that would not leak. This tool was de-



Details of a tool for repairing the check valve casings of triple valves

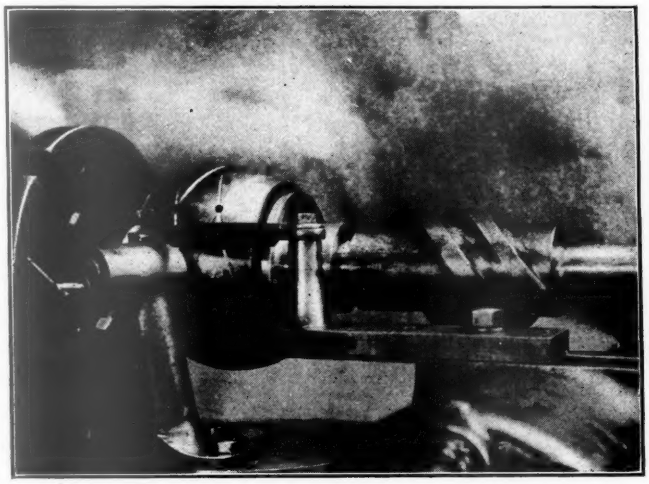
signed to handle this particular operation more conveniently.

The tool consists principally of a die and guide made of hardened steel which serves to clean and rethread the threaded portion of the check valve casing. The flange of the die and guide is knurled for ease in handling. The cylindrical portion of this piece is bored out to serve as a guide for the counter-bore and facing tool which, as its name implies, is used to counter-bore the union joint and to clean up the face. An adjusting collar provided with two handles is tapped out to fit over the threaded exterior diameter of the die and guide so that the shoulder on the inside of the adjusting collar exerts a pressure against the body of the counter-bore and facing tool. The shank of the facing tool extends through the opening in the adjusting collar and, with the pressure of the facing tool controlled by the adjusting collar, the facing tool is operated by hand or power applied to the square end of the shank.

Engine lathe ball turning and boring attachment

By J. W. Etheridge
Tool foreman, Central of Georgia, Macon, Ga.

THE illustrations show an attachment applied to an 18-in. Hendy lathe, for machining ball knuckle bushings used on the front and front intermediate side rod connections of Santa Fe locomotives. The base of this attachment is planed and scraped to fit the inside ways of the lathe. It is sufficiently narrow to permit the carriage extensions to miss the front and back of the base block, thus permitting the tool rest to move up close to the base plate.



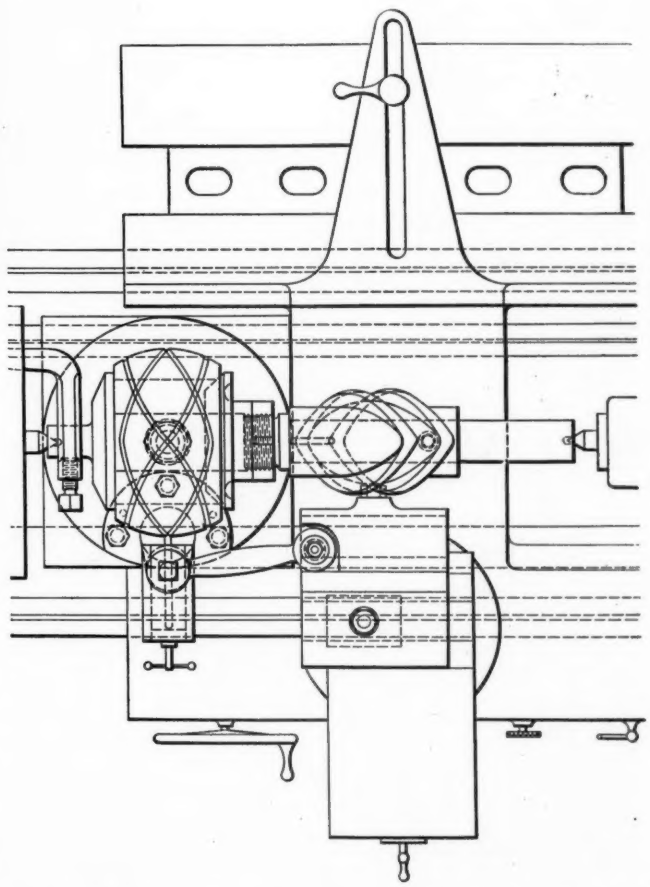
Cutting the oil grooves in the spherical bushing

Particular care was taken in locating the center on the base plate with respect to the lathe centers as the axis of the base plate has to be perpendicular to the axis of the lathe centers. Three height marks were made on the base block using the lathe shears as working points. These marks were used for chucking the base plate in the lathe when turning the top bearing and facing to the right height. A brass band is shrunk on the top side of the base plate which forms the thrust and journal bearing. The top plate, or turntable, is next fitted to the base plate with .0005 in. allowed for the journal fit. The brass lateral bushing in the center of the turntable is faced so as to give the table just enough friction on its base to be felt when pulling it around by hand.

The upright arm that carries the tool holder and boring bar is located on the turntable. This is done by bushing the horizontal hole in the top of the arm and fitting a piece of 5/16-in. drill rod in the bushing, long enough to extend out to the center of the base plate. The center hole in the base plate is treated in a like manner, with a rod extending up to meet at right angles the rod from the arm. With the rod set correctly, it is held in place by two tapered dowel pins, while three ⅝-in. cap screws are pulled tightly in place.

The tool holder is designed to carry ⅜-in. square tool steel. The bottom half of the tool holder is ⅛ in. above the center line. This is to insure a good thrust on either side of the holder. The top half of the holder is held in place by one ½-in. set screw with a 90-deg. point which engages in one of a series of cross slots. This arrangement is for quick adjustment from large to small bushings.

The top half of the tool holder is a full circle in the back, close to the bottom of which a hole is drilled and shouldered into which fits a ⅜-in. left hand screw. The bottom part of the tool holder is tapped in the back for ⅜ in., 16 left-hand threads. This set screw is used for making small adjustments of the cutting tool. A vertical pin is located at the end of the arm that holds the tool fixture. One end of a short connecting rod slips over this pin and the other end slips over a pin which is clamped on the lathe carriage in place of the tool post. A longitudinal movement of the carriage causes the tool head of the device to swing and feed the tool in a true circle.



The attachment in position on a lathe for turning and cutting oil grooves

Turning the outside of a bushing

A bushing to the be turned on the outside is placed on a flanged mandrel. Another flange or collar with a 45-deg. cone face slips over the mandrel and partly in the hole through the bushing and is tightened with a

spanner nut. Behind this nut is fitted one of two cams made for this device. The cams are used for cutting uniformly the four oil channels on the spherical bushing after it has been turned to the proper diameter.

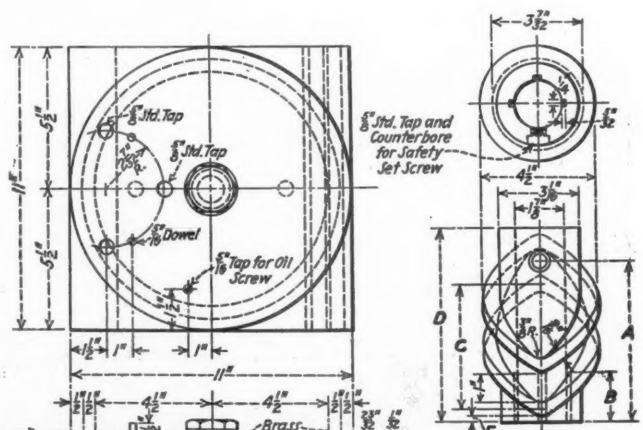
Method of holding the cam in position on the mandrel

One of the illustrations shows the cam, which has four keyways or slots cut in its surface. The end of the mandrel over which the cam fits has only one feathered keyway, but also has four set screw pockets in one place and three in another. These are for the purpose of holding the cam in its proper position on the mandrel depending on the size of the bushing. By referring to the general drawing it will be seen that the guide roller and guide bearing, which actuates the cam, and in turn the cutting tool, are assembled in the tool post slot. The cutting tool is brought up to the center line of the bushing after which the lathe carriage is clamped to the lathe so that there will not be any longitudinal movement. In this position, the bushing and arbor revolve on the lathe center. The roller on the cam guide pin will travel in the cam slot and consequently the cutting tool will travel back and forth over the turned face of the bushing reproducing oil grooves similar in contour to the slot in which the cam guide pin revolves. When one oil channel has been cut on the bushing, the lathe is stopped, the cross feed is backed out and the cam roller is thereby disengaged from the cam slot; then the set screw which holds the cam in position on the arbor is loosened, the cam pulled back toward the tool stock center until it clears the feathered key in the arbor. The cam is then turned until the next keyway comes in line with the key

The attachment set up to bore out and cut the oil grooves in the socket bushing

in the arbor, after which the cam is pushed back over the keyway arbor and tightened in place with a set screw. The cross feed is then run in until the roller engages in the cam slot. The second oil groove is then cut. This operation is repeated until all the oil grooves are cut.

The cams are made on a No. 3 Hendey milling machine. They are first bored out to slip over one end of the mandrel on which fits the bushing to be grooved. After this operation the cams are pressed on a lathe mandrel and turned and faced the correct diameter ($4\frac{1}{2}$ in.) and length. When machining the longer of the two cams, the milling machine was set to cut a 10-in. lead. Two lines parallel with the center line of the cam were laid out on the surface 180 deg. apart. The cam was then placed on the milling machine centers. A 1-in. end mill was used the center of which was set to the same height as the dividing head and tail stock centers. The cam was then rotated until one of the lines was exactly at the height of the center of the end mill and at the proper distance from the tool to start a cut. The end mill was then fed to the proper depth and then the feed started.



Small Cam		Large Cam	
A	4"	A	$6\frac{1}{4}$"
B	$1\frac{5}{8}$"	B	$1\frac{13}{16}$"
C	2"	C	5"
D	$4\frac{13}{16}$"	D	$7\frac{1}{2}$"
E	$\frac{15}{32}$"	E	$\frac{5}{32}$"
3 Keyways 120° Centers		4 Keyways as shown	

The left view shows the base plate and turn-table construction—The right view shows how the cams are laid out

This cut was allowed to run until the other line on the cam was exactly the same height as the center of the end mill, thus the cutter had travelled half way around the cam bushing, or a distance of 5 in. At this point the machine was stopped and the feed was reversed. In reversing the feed, it is also necessary to reverse the spiral which was done by placing an intermediate gear in the train of gears which operate the dividing head. This reverses the cut or makes it run the same direction throughout the operation. After this is done, the machine is again started and the end mill allowed to feed around the cam until it comes to the original starting point.

When boring the spherical bushing, a 10-in. Wescott Universal chuck is used with a short extension between the lathe spindle nose and the chuck. The chuck stands well above the holder from the upright arm. The boring bar, which is made exactly long enough for its turning center to pivot in a parallel line above the center of the bed plate attachments, is then inserted. The tool holder is then placed in the boring bar. The feed driver in the tool post tee-slot is put in place and the connecting rod is attached, after which the bushing is bored by using the cross feed. It is important that the bushing to be bored or turned is located in the center of the attachment.

Setting Walschaert valve gear—Who is right?*

By *L. K. Botteron*
Special apprentice, A. T. & S. F., Fort Madison, Iowa

In the December, 1926, issue L. V. Mallory described a method for setting the eccentric crank and correcting the eccentric rod length, the method being based upon the following assumptions; first, that the distance *BF*, Fig. 1, (which was Fig. 5 in Mr. Mallory's article) scribed on the cylinder jacket equals the throw of the eccentric crank, and second, that the point *O* corresponding to the link foot pin position when the engine is on either dead center, lies mid-way between points *B* and *F*, if the eccentric rod is of the correct length.

Either a graphical or mathematical analysis of the Walschaert valve gear will readily disprove both of these assumptions. The line diagram shown in Fig. 2 is of a correctly designed Walschaert valve gear. The link is shown in three positions; full back, center and full ahead. The link has the same angular swing either side of its neutral or central position or in other words, referring to the diagram, angle *BEO* equals angle *OEF*.

Now, referring to Fig. 1, line *D-D*, extended, would pass very nearly mid-way between points *B* and *F* and the long tram used would make very nearly the same angle with the horizontal when the link was either full ahead or full back. Therefore, the distance *BF* in Fig. 1 equals the distance *BF* in Fig. 2. Point *O* in Fig. 1 does not exactly correspond to point *O* in Fig. 2, due to a slight difference in the angularity of the tram compared with positions *B* and *F*, but the difference is so slight that it will not be taken into consideration here. Moreover, no account was taken of it in the original article. Therefore, distances *BO* and *OF* in Fig. 1, may be taken equal to distances *BO* and *OF* in Fig. 2.

As shown on the diagram, the link is at its extreme positions both forward and backward when the eccentric crank, link foot pin, and center of the main driving wheel center all lie on the same straight line. Using the following notation:

ϕ and ω = the angles made by the eccentric rod with the horizontal when the link is respectively full forward and full back.

L = the length of the eccentric rod.
T = the throw of the eccentric crank.

Then the distance $BF = \left(L + \frac{T}{2}\right) \cos\phi - \left(L - \frac{T}{2}\right) \cos\omega$

Referring to Fig. 2, expressions for the distances *BO* and *OF* are:

$$BO = S \cos BEA - S \cos OEA$$
$$OF = S \cos OEA + S \cos FED$$

An inspection of the formulas and the diagram shows that in order for the assumptions in the original article to be correct, the center of the link foot pin in its neutral

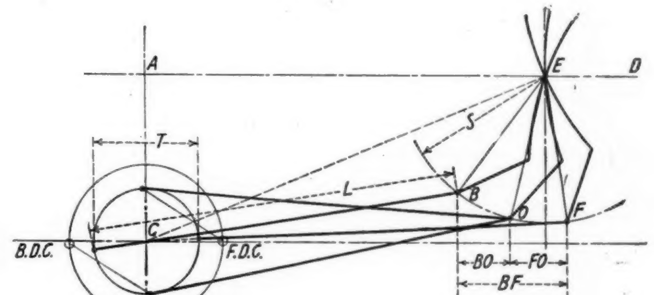


Fig. 2—A line diagram used for a mathematical solution of the problem

position must lie on a vertical line dropped from the center of the link trunnion, and that the following equation must be satisfied:

$$T = \left(L + \frac{T}{2}\right) \cos\phi - \left(L - \frac{T}{2}\right) \cos\omega$$

Also it must be remembered that the link must have the same angular swing on either side of its neutral position. Obviously, all three of these conditions cannot be fulfilled by any practical arrangement and design of the parts involved.

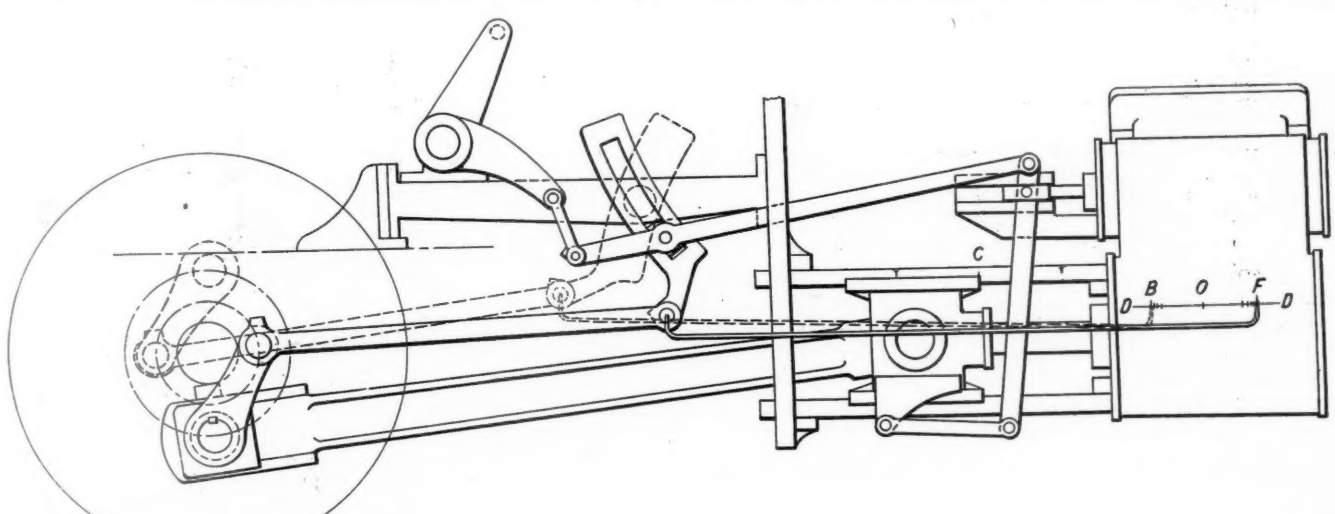


Fig. 1—Does BF equal the throw of the eccentric crank and does BO equal OF?

The following example is calculated from a Walschaert gear used on a heavy Pacific type locomotive. All dimensions given are from the gear as designed or in other words the erecting card dimensions.

AC = 30 in.
AE = 71 5/8 in.
S = 26 3/16 in.
L = 65 7/8 in.
T = 19 1/4 in.

*The following is a discussion of an article entitled "A dependable method of setting the Walschaert valve gear" by L. V. Mallory, which appeared on page 765 in the December, 1926, issue of the *Railway Mechanical Engineer*.—Editor.

$$CF = L + \frac{T}{2} = 75\tfrac{1}{2} \text{ in.}$$

$$CB = L - \frac{T}{2} = 56\tfrac{1}{4} \text{ ins.}$$

(1) Solving for angle ACE

$$\text{Tan ACE} = \frac{71.5}{30} = 2.3833$$

$$\text{Angle ACE} = 67^\circ\ 14.3'$$

(2) Solving for angle ECF, solve triangle ECF by law of cosines,

$$\text{Cos ECF} = \frac{(CF)^2 + (CE)^2 - (EF)^2}{2\ CF\ CE} = \frac{(75\tfrac{1}{2})^2 + [(71\tfrac{1}{2})^2 + (30)^2] - (26\tfrac{3}{8})^2}{2\ (75\tfrac{1}{2})\ \sqrt{(71\tfrac{1}{2})^2 + (30)^2}}$$

$$\text{Cos ECF} = \frac{11017}{11708}$$

$$\text{Angle ECF} = 19^\circ\ 47.2'$$

(3) Using law of cosines to compute angle ECB

$$\text{Cos ECB} = \frac{(CB)^2 + (CE)^2 - (EB)^2}{2\ CB\ CE} = \frac{(56\tfrac{1}{4})^2 + [(71\tfrac{1}{2})^2 + (30)^2] - (26\tfrac{3}{8})^2}{2\ (56\tfrac{1}{4})\ \sqrt{(71\tfrac{1}{2})^2 + (30)^2}}$$

$$\text{Cos ECB} = \frac{8480.7}{8723.1}$$

$$\text{Angle ECB} = 13^\circ\ 32.3'$$

(4) Angle FCA = Angle ECF + Angle ACE = $19^\circ\ 47.2' + 67^\circ\ 14.3' = 87^\circ\ 1.5'$

$\phi = 90^\circ -$ Angle FCA $= 90^\circ - 87^\circ\ 1.5' = 2^\circ\ 58.5'$

(5) Angle BCA = Angle ECB + Angle ACE = $13^\circ\ 32.3' + 67^\circ\ 14.3' = 80^\circ\ 46.6'$

$\omega = 90^\circ -$ Angle BCA $= 90 - 80^\circ\ 46.6' = 9^\circ\ 13.4'$

(6)

$$BF = \left(L + \frac{T}{2} \right) \cos \phi - \left(L - \frac{T}{2} \right) \cos \omega$$

$$= 75.398 - 55.523 = 19.875 = 19\tfrac{7}{8}''$$

(7) Solving for Angle BEC, take triangle BEC,

$$\text{Cos BEC} = \frac{(EB)^2 + (CE)^2 - (CB)^2}{2\ EB\ CE} = \frac{(26\tfrac{3}{8})^2 + [(71\tfrac{1}{2})^2 + (30)^2] - (56\tfrac{1}{4})^2}{2\ (26\tfrac{3}{8})^2\ \sqrt{(71\tfrac{1}{2})^2 + (30)^2}}$$

$$\text{Cos BEC} = \frac{3543.8}{4090.2}$$

$$\text{Angle BEC} = 29^\circ\ 57.3'$$

(8) Solving for Angle FEC

$$\text{Cos FEC} = \frac{(EF)^2 + (CE)^2 - (CF)^2}{2\ (EF)\ (CE)} = \frac{(26\tfrac{3}{8})^2 + [(71\tfrac{1}{2})^2 + (30)^2] - (75\tfrac{1}{2})^2}{2\ (26\tfrac{3}{8})\ \sqrt{(71\tfrac{1}{2})^2 + (30)^2}.}$$

$$\text{Cos Fec} = \frac{1007.6}{4090.2}$$

$$\text{Angle FEC} = 75^\circ\ 44.3'$$

(9) Angle CEA = 90 − Angle ACE = $90 - 67^\circ\ 14.3' = 22^\circ\ 45.7'$

(10) Angle BEA = Angle BEC + Angle CEA = $29^\circ\ 57.3' + 22^\circ\ 45.7' = 52^\circ\ 43'$

(11) Angle FEA = Angle FEC + Angle CEA = $75^\circ\ 44.3' + 22^\circ\ 45.7' = 98^\circ\ 30'$

(12) Angle FED = 180 − Angle FEA = $180 - 98^\circ\ 30' = 81^\circ\ 30'$

(13) Swing of link = Angle FEC − Angle BEC = Angle BEF = $75^\circ\ 44.3' - 29^\circ\ 57.3' = 45^\circ\ 47'$

(14) Angle OEA = Angle BEA + Angle BEO = $52^\circ\ 43' + \frac{45^\circ\ 47'}{2} = 75^\circ\ 36.5'$

(15) BO = S cos BEA − S cos OEA $= 26\tfrac{3}{8}\ (.60576 - .24855) = 26\tfrac{3}{8}\ (.35721) = 9.421$

(16) OF = S cos OEA + S cos FED $= 26\tfrac{3}{8}\ (.24855 + .14781) = 26\tfrac{3}{8}\ (.39636 = 10.454$

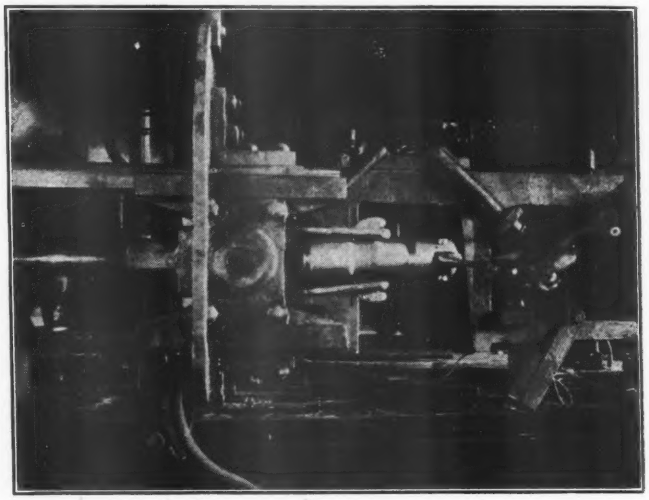
A solution may be more quickly obtained by making an accurate drawing and scaling distances *BO*, *OF*, and *BF*. It will be noted that *T* equals 19¼ in. while *BF* equals 19.875 in. Also *BO* equals 9.421 in. while *OF* equals 10.454 in., which mathematically proves that Mr. Mallory's original assumptions were not correct.

Jack for removing piston rods

By J. L. Malone

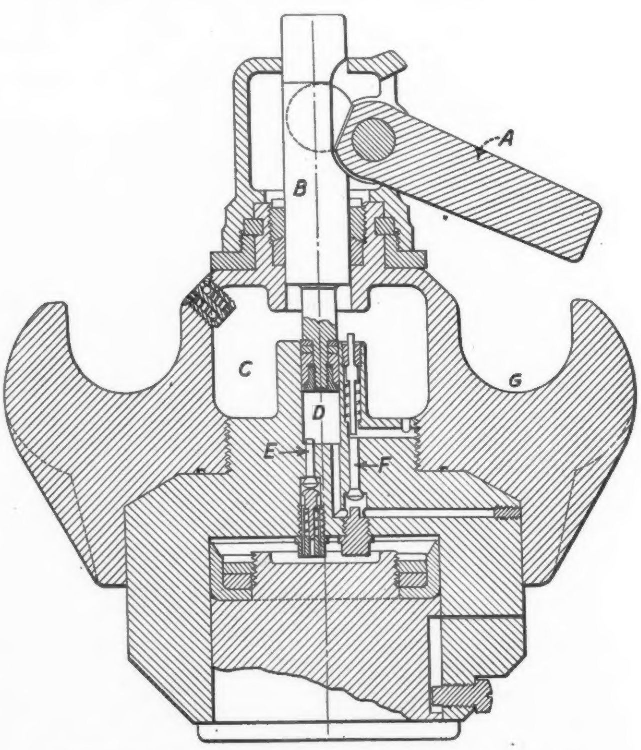
Machine foreman, Mobile & Ohio, Jackson, Tenn.

THE drawing accompanying this article shows the design of a special type of hydraulic jack particularly adapted to the removal of locomotive piston rods from the crosshead. While designed for this special purpose, this jack will also be found suitable for general use. The photograph shows the application of the jack for the removal of piston rods. A jack of this type designed for a capacity of 100 tons has a weight of somewhat less than 100 lb., making it especially useful as a portable tool. The jack is designed with a swivel head which rotates independently of the ram, making it possible for the operating lever to be manipulated from any angle while the jack is under pressure. Referring to the drawing, the plunger *B* when operated by the operating lever *A* forces the liquid from the reservoir *C* down through the check valve at *E*, thereby forcing the ram out against the work. In order to release the pressure from the jack, the operating handle is pulled back into the extreme position. This forces the plunger down against the valve stem of the check valve at *E*,



The jack, with the tie rods in place, ready to remove a piston rod

thereby permitting the liquid confined in the ram cylinder to flow back through the check valve *E* through ports and the valve *F* into the reservoir at *C*. In using this jack for the removal of piston rods the illustration clearly shows how tie rods are hooked over the lugs cast to the



Details of piston rod jack showing how it is operated

body of the jack. The head, lever and body of the jack may be made of cast steel or, if desired, may be forged. The working parts of the jack are made of machine steel.

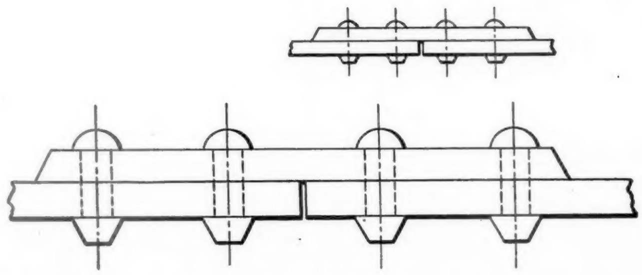
This jack is of such size that, by means of the tie

rods, it may be applied to most any size or type of crosshead. The time required to remove a piston rod from the crosshead after the jack has been set in place varies from one to five minutes.

Using a two-foot rule for rivet sketches

By F. W. Bentley, Jr.
Missouri Valley, Iowa

ROUGH sketches made in the shop or out on the job are never expected to measure up to the appearance of a finished drawing made with drawing instruments. However, preliminary job sketches are often made a matter of record and filed away and where there is a possibility of this being the case it is worth while to make them as neatly as possible. The illustration and



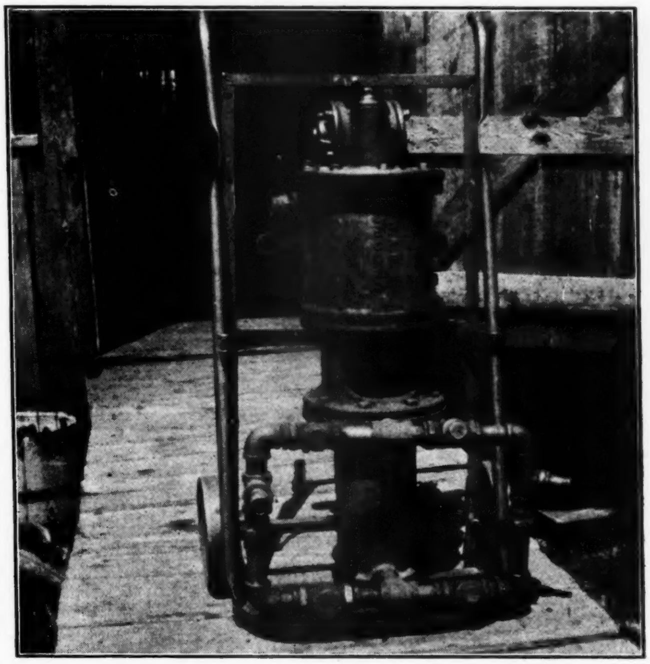
How to use a two-foot rule to make sketches like those shown in the drawing

drawing accompanying this article show how excellent sketches can be made of boiler seams or riveted joints by simply using the large and small joints of a two-foot rule. The larger heads and circles are made with the middle joint and the smaller scale sketches are made with the small joint separating the six-in. sections. It is surprising how easily and neatly a fairly sharp pencil will follow the openings in the rule producing work comparable in appearance to that usually seen on finished drawings.

Hydrostatic pressure pump

THE illustration shows a locomotive cold water, hydrostatic pressure pump made from a discarded 11-in. air compressor. The air cylinder has been replaced by a 4-in. cylinder cast in the brass foundry. At each end of this cylinder, beyond the travel of the piston, is located a 1½-in. hole for the supply and discharge outlets. The piston in the brass cylinder is attached to the end of the steam cylinder piston rod.

A tee and a short nipple is screwed into each of the two 1½-in. holes. Sixteen short nipples, four elbows, four check valves and two unions are assembled with the two tees to form the rectangular loop shown in the illustration. A tee is located in each side of the rectangle



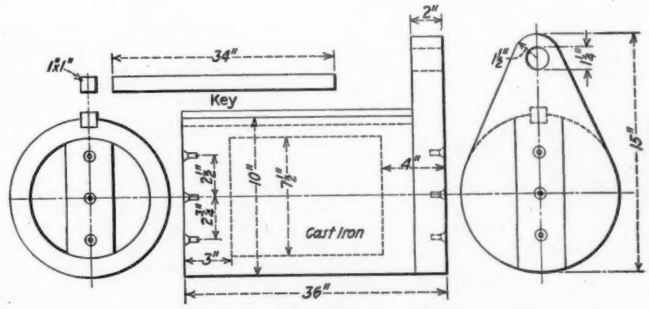
Hydrostatic pressure pump made from a discarded air compressor

for connecting up the supply and discharge pipes. The check valves at one side of the loop operate as admission and those at the other side operate as discharge valves. The steam cylinder is connected to the shop steam line.

Turning eccentrics on an engine lathe

By H. H. Henson
Machine shop foreman, Southern, Chattanooga, Tenn.

ALTHOUGH the modern locomotive is equipped with outside valve motion, there still remain in service many engines, with Stephenson link motion. The machining, on an engine lathe, of the rough eccentric

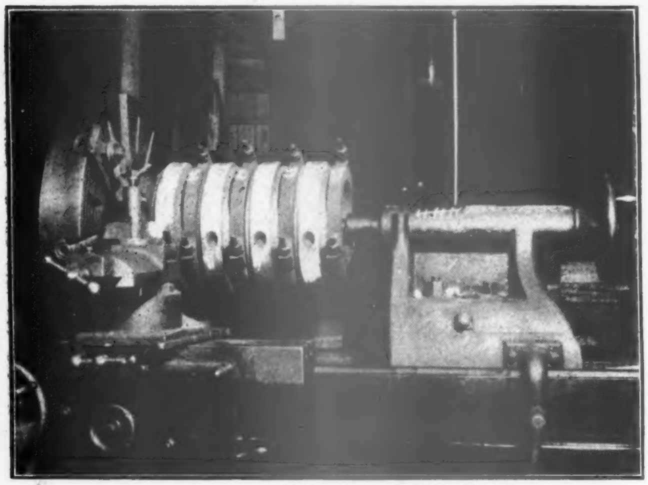


A mandrel used for turning eccentrics on an engine lathe

castings can be expedited by using the mandrel shown in the illustrations.

The eccentric castings are first bolted together and then bored to the size of the main driving axle. As four eccentrics comprise a set for a locomotive, this

number is placed on the mandrel shown in the drawing. The mandrel can be designed to accommodate two different throw eccentrics, provided the bore is the same. For example, some locomotives have a 5-in. throw eccentric and some a 5½-in. The mandrel is then placed between the lathe centers and the eccentrics turned to size on the outside as shown in the illustration. This method insures the accurate setting of the eccentrics on

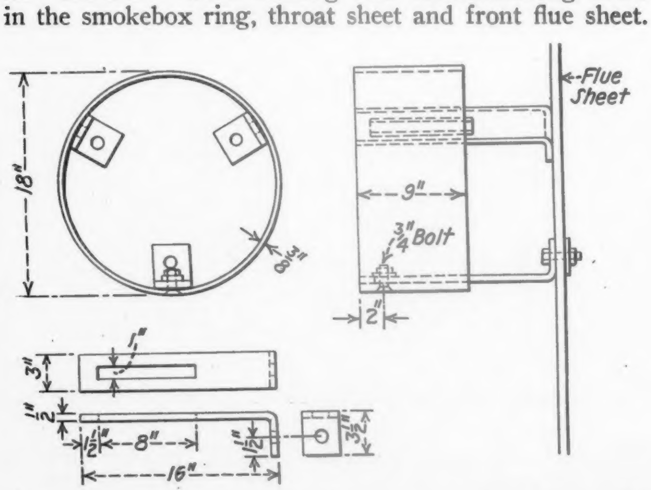


A set of four eccentrics mounted on a mandrel and ready for turning

the axle as the modern practice of setting valves is to lay off the keyways on the main driving axle and machine them while the wheels are on the floor. Turning the eccentrics on the mandrel makes it possible to key the blocks on the axle before the wheels are placed under the locomotive. After the eccentrics are placed on the axle, all that is necessary is to check up the cutoff after all of the valve gear parts have been assembled.

Drilling holes in the smoke box ring

One of a number of fixtures and devices developed by the employees of the Lehigh Valley shops at Sayre, Pa., is a device designed to eliminate the use of an "old man" when drilling and countersinking holes in the smokebox ring, throat sheet and front flue sheet.



Device designed to eliminate the use of an "old man" when drilling and countersinking holes in the smokebox ring, throat sheet and front flue sheet

Its use not only does away with the "old man" but speeds up the drilling and lets one man do the work formerly done by two.

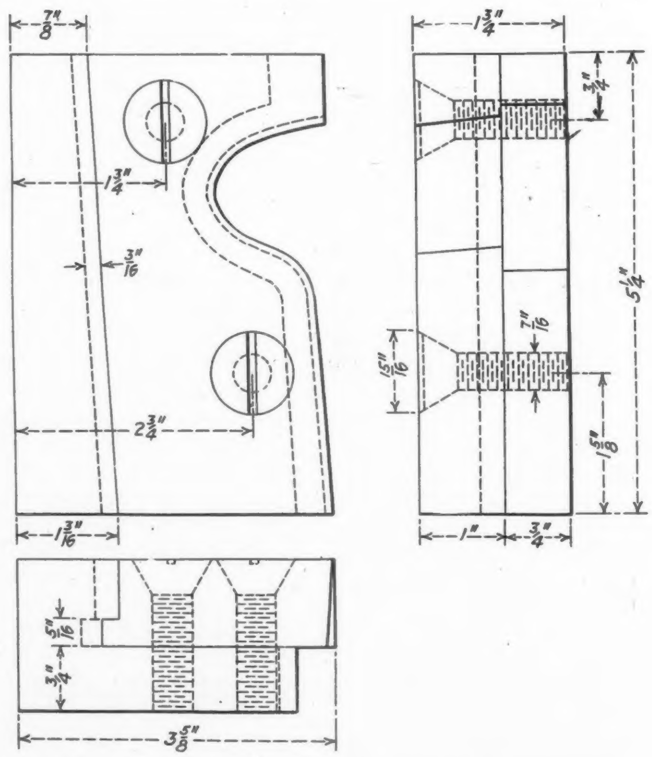
A piece of ⅜-in. boiler plate is made into a drum, 18 in. in diameter and 9 in. long. Three legs are bolted to the inside of the drum which extend out of one end about 5 in. The projecting ends of each leg is provided with a foot in which is drilled a hole for a ¾-in. bolt. The drum is held with its axis parallel to the boiler axis and is bolted to the flue sheet near the center by means of bolts passing through the feet and the flue sheet. In this position a firm foundation is provided for the drilling motor used in drilling or countersinking around the smokebox ring, flue sheet or throat sheet.

No movement of the drum is required as all the holes around the drum may be reached and a firm backing given to the drill motor. After the drum is in place, one boilermaker can drill an average of thirty 1 1/16-in. holes per hour, whereas before it was used, a boilermaker and helper could drill but twelve 1 1/16-in. holes per hour.

Block for holding driving tire forming tool

By J. Robert Phelps
Apprentice instructor, A. T. & S. F., San Bernardino, Cal.

A BLOCK for holding tire forming tools in a boring mill tool post, which is shown in the drawing, has been designed by a machinist at these shops. The tools, which are held in the block, are used to form the outside of



Block for holding tire forming tools in a boring mill tool post

the driving wheel tires. The block for setting the forming tool in is on the same principle as is used on wheel lathes. The application of this block for turning tires has made it possible to obtain considerable additional service out of the forming tools and to hold them much more rigidly.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Setting safety valves—An answer

BATTLE CREEK, Mich.

TO THE EDITOR:

A question by F. O. Robinson was published in the March, 1927, issue on how to get an approximate setting on a safety valve before returning it to the boiler. A very satisfactory device for setting safety valves has been in operation at these shops for some time. This device is used largely for back shop work, not only for the purpose of setting safety valves, but also for the purpose of testing whistle valves, boiler blow-off cocks and cab valves.

The device consists essentially of an 11-in. air compressor, the air end of which has been reduced to 7 in. and a 30,000 cu. in. capacity reservoir. The air compressor boosts the pressure of the air taken from the shop air line from 100 lb. to 250 lb. as the air passes into the reservoir.

The reservoir is filled with a pipe which is provided with fittings to which the safety valves, whistles, etc., can be easily secured. It is also fitted with a pressure gage. This gage is located on the lower part of the reservoir so that the moisture carried in the compressed air will have as little effect on the reading of the gage as possible. The device is supported on a stand so that the height of the pipe to which the various appliances are attached is at a suitable height for the workman.

A. SELBEE,
Gang foreman, Grand Trunk.

Spokes breaking on main drivers

PRESCOTT, Ariz.

TO THE EDITOR:

An inquirer in the March, 1927, issue asks why the short spokes break between the hub and counterbalance on driving wheels. It has been my observation that this condition is caused by tires being applied too tightly or with too much shrinkage allowance and that the trouble develops more often on passenger than on freight locomotives, because of the larger diameter of the wheels.

A very tight tire will deflect the long wheel spokes while the short spokes between the counterbalance and the wheel hub, as well as between the main pin hub and the wheel rim, will remain rigid. The excessive compression breaks up the fibre of the metal so that they crack and crush out small particles of the crushed material.

It is not unusual to have the long wheel spokes break from the same cause on steel wheel centers, but if close inspection is made, it will generally be found that these spokes bend first and start to crack on the inner side of the bend and at the weakest part of the spoke. This indicates that the tight tires are the primary cause, the long spokes deflecting and breaking from bending, and the short spokes breaking from compression.

The expansion and contraction of the tire under heavy braking, also the so-called "hammer blow" of the counterweight do, no doubt, contribute to cracked spokes, especially if the locomotive is not correctly counterbalanced, but it has been my observation that tires applied too tightly are the greatest offenders.

CHARLES RAITT,
Assistant Master Mechanic, A. T. & S. F.

Inadequate inspection

ALTOONA, Pa.

TO THE EDITOR:

Examination of the fifteenth annual report of the Bureau of Locomotive Inspection for the year ending June 30, 1926, discloses the fact, that the average percentage of defective locomotives found on all the railroads by the bureau's inspectors was 40. This would seem to indicate, either a greater degree of co-operation with the government inspectors, or a greater effort to maintain a higher locomotive efficiency.

The railroads are deserving of commendation for this excellent showing which is the best since the locomotive inspection law went into effect in 1911. The nearest approach to this figure was that of 44.4 per cent in 1914.

I have had the opportunity of looking over motive power on several different railroads of the country and have formed the opinion that, barring some minor contributory causes, the main reason for a high percentage of defective power is inadequate inspection both on the part of the enginemen and the terminal inspectors.

I have also found that mechanical department officers are proud of the motive power on their lines. This is only natural, but why do so many of them seem to loose interest in their locomotives after having placed them in service? Why leave the responsibility of maintenance to minor officers? It is my opinion that a high percentage of defective power on a road indicates either a lack of interest or of efficiency on the part of the head of the department. Nor can he side step this responsibility for he is kept informed of the general condition of the power at the different terminals, if by no other means than by the report received from the Bureau of Locomotive Inspection each month.

As a means of improving this situation, why not appoint qualified men to positions to be classified as general motive power inspectors, these men to work under the direct supervision of the head of the motive power department, visiting all points where locomotives are housed or inspected, making personal inspection of such locomotives and checking up on enginehouse practice along the same lines as those followed by federal inspectors. They should be clothed with sufficient authority to require the defects found to be repaired before a locomotive is again returned to service, as well as to order out of service those operated in violation of government regulations.

I would suggest that the subject, inadequate locomotive inspection, its result and remedy, would be an interesting subject for discussion at the next convention of the Traveling Engineers' Association.

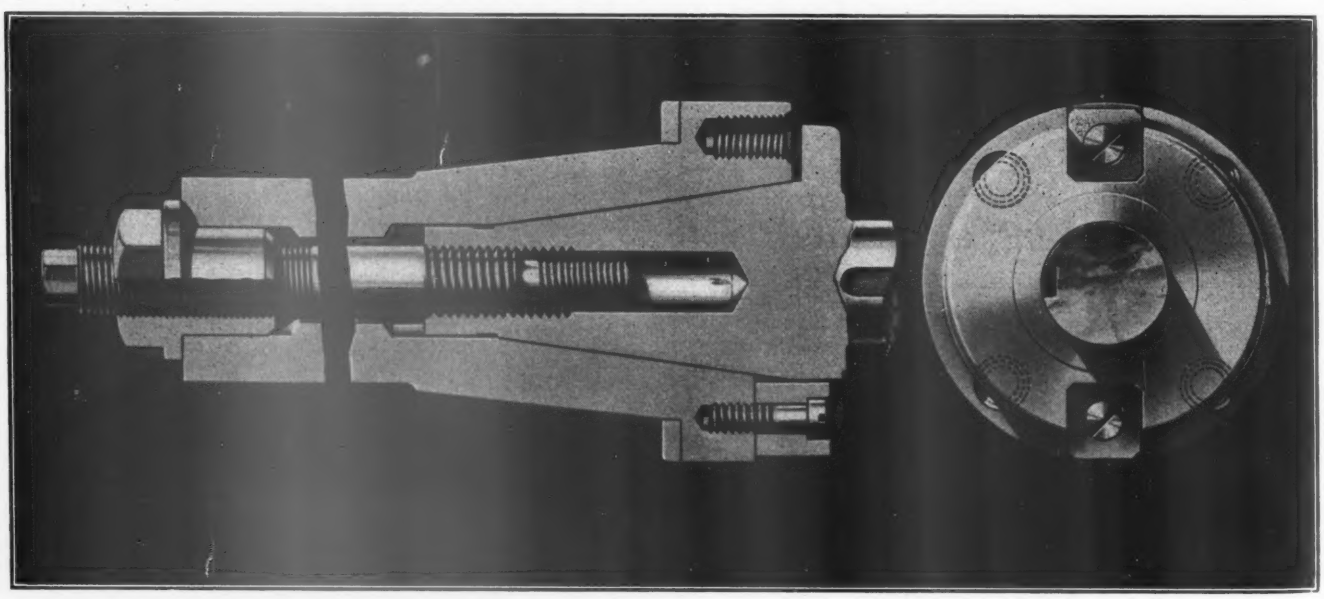
A READER.

Standard spindle end for milling machines

NINE manufacturers of milling machines have co-operated in the development of a spindle end which henceforth shall be the standard design on all milling machines from 2 to 25 hp. capacity produced by the several companies involved. These companies are: Brown & Sharpe Manufacturing Company, Providence, R. I.; Cincinnati Milling Machine Company, Cincinnati, Ohio; Hendey Machine Company, Torrington, Conn.; Kearney & Trecker Corporation, Milwaukee, Wis.; Kempsmith Manufacturing Company, West Allis, Wis.; R. K. LeBlond Machine Tool Company, Cincinnati, Ohio; Oesterlein Machine Company, Cincinnati, O.; Reed-Prentice Company, Worcester, Mass., and Sundstrand Machine Tool Company, Rockford, Ill.

During a period of 23 years there has been a continued demand for a standard milling machine spindle end which finally resulted in the selection of a committee of engineers who were to pool their experiences and ideas and co-operatively produce the best possible design for use as a standard. A survey of the industry revealed the sticking taper as the one undesirable feature common to all the present types of spindle ends. Practically all manufacturers had eliminated the sticking of face milling cutters and chucks on the spindle, but nothing had been done to prevent arbors from "freezing" in the taper hole of the spindle. Some shops reported that it was their practice never to allow an arbor to remain in a spindle more than two days—that if a set-up was in use for a longer period, the arbor must be taken out of the spindle and reassembled at the end of each two days run.

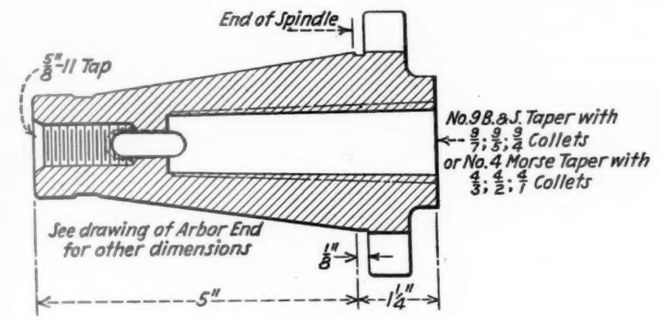
All the manufacturers and a great many users can cite instances of arbors becoming jammed in the spindle, it being often necessary to destroy either the arbor or spindle and sometimes both in attempting to release them.



Sectional view of the new spindle end showing the arbor and arrangement of draw-in bolt

The standard spindle end and arbor as evolved by the committee has a taper of 3½ in. per foot, a taper that experience has shown will not freeze or stick. The taper serves only the purpose of accurately centering the arbor and providing an area of intimate contact between the arbor and spindle. The arbor is driven by tongues on the face of the spindle and a draw-in bolt of large diameter holds the arbor firmly in place. The draw-in

bolt is new in design and can be tightened without subjecting it to torsional strains. Several machines were equipped with this new style spindle and arbor and thoroughly tested in different shops. The tests and research have extended over a period of more than two years and have included extreme tests with steep angle spiral mills set so that they would tend to free the arbor in the spindle hole. As high as 35 hp. has been transmitted.



The other type of adapter used for end mills and collets with tongue drive

Some of the advantages to the user claimed for this new standardized spindle end are as follows:

1—Complete interchangeability of all arbors and face milling cutters for any size or make of milling machine from 2 to 25 hp. capacity.

2—Reduction in cost of equipment due to simplification and elimination of the countless sizes and variety of milling arbors and cutters now in use.

3—New step angle taper (3½ in. per ft.) insures instant release of the arbor; it cannot stick in the spindle.

4—The inner end of the spindle hole is bored straight for the arbor pilot, thereby keeping the arbor in place while inserting or removing the draw-in arbor bolt.

5—The steep taper with its large diameter bore at the outer end of spindle allows the use of stronger arbors, particularly where cutters must be extended.

6—The large diameter draw-in arbor bolt can be tightened under heavy pressure to hold the arbor firmly in the taper.

7—The front end of the arbor draw-in bolt is provided with an extension threaded end for holding auxiliary equipment.

8—A complete set of new arbors has been adopted, standardized as to diameter, length, keyway, bearing size and numbering. This new series of arbors can be used on any size milling machine from 2 to 25 hp.

The three styles of arbors standardized are Style A, teated arbors; Style B, plain arbors, and Style C, shell end-mill arbors.

The standard teat or pilot of the Style A, teated arbors, is to be 23/32 in. (between .7180 in. and .7185 in.) diameter and 1½ in. long. Five sizes standardized are as follows:

⅞ in. dia.	10 in. long, shoulder to nut
1 in. dia.	12 in. long, shoulder to nut
*1 in. dia.	18 in. long, shoulder to nut
1¼ in. dia.	12 in. long, shoulder to nut
*1¼ in. dia.	18 in. long, shoulder to nut

*These arbors also to have long bearing for arbor pendant

There are 10 sizes of Style B, plain arbor, standardized as follows:

1 in. dia.	24 in. long, shoulder to nut
1¼ in. dia.	24 in. long, shoulder to nut
1½ in. dia.	18 in. long, shoulder to nut
1½ in. dia.	24 in. long, shoulder to nut
1½ in. dia.	30 in. long, shoulder to nut
1½ in. dia.	36 in. long, shoulder to nut
2 in. dia.	30 in. long, shoulder to nut
2 in. dia.	36 in. long, shoulder to nut
2½ in. dia.	30 in. long, shoulder to nut
2½ in. dia.	36 in. long, shoulder to nut

The threads for all Style B arbor nuts are to be 10 threads per in., U. S. Form, Class 2 fit. The above arbors are furnished with two bearings, bearing diameters to be selected by the customer to suit his machine.

Style C arbors for shell end mills conform to the standard shell end mills now in process of standardization by the Milling Cutter Committee under American Engineering Standards Committee procedure.

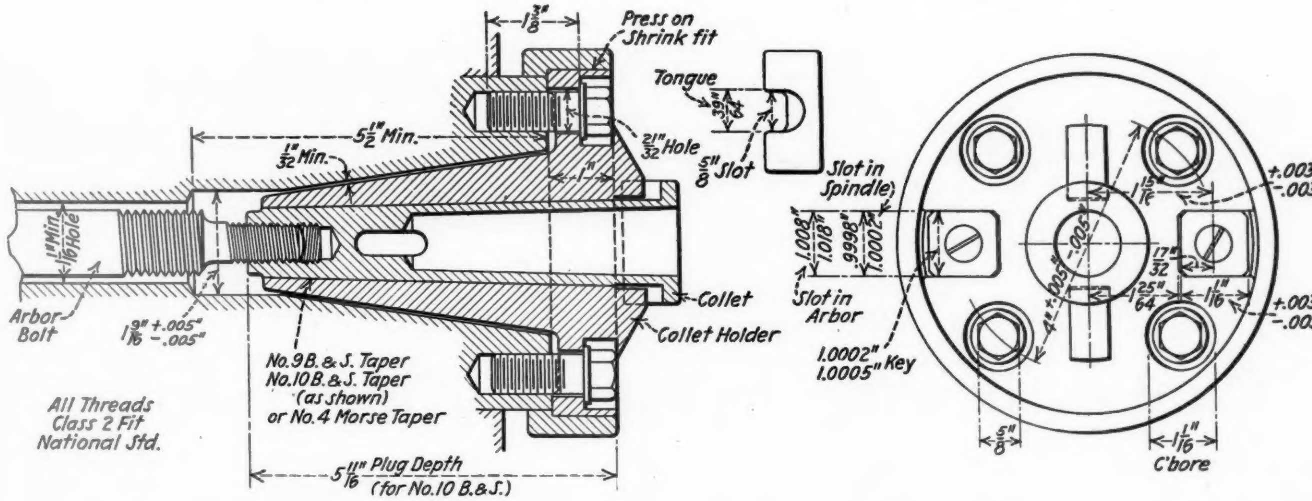
All Style A and Style B arbors are to have the new standard keyways tentatively adopted by the cutter manufacturers and now in process of standardization by the Milling Cutter Committee under American Engineering Standards Committee procedure.

A standardized nomenclature or numbering was adopted by the committee as it was felt that a uniform numbering system was needed for the new standard arbors. The names of the three types of arbors have already been indicated. The bearing sizes are designated thus:

1⅞ in. dia.	No. 3	(For arbors up to and including 1¼ in. dia.)
2⅛ in. dia.	No. 4	(For arbors up to and including 1½ in. dia.)
2¾ in. dia.	No. 5	(For arbors up to and including 2 in. dia.)
3⅜ in. dia.	No. 6	(For arbors up to and including 2½ in. dia.)

The arbor symbol is made up of the arbor diameter, style, length shoulder to nut, and the bearing number, thus:

1A 12 = teated arbor 1 in. in diameter, 12 in. long.
1¼A 18-4 = teated arbor 1¼ in. in diameter, 18 in. long with bearing 2⅛ in. diameter.
1½B 30-5 = plain arbor 1½ in. in diameter, 30 in. long with bearing 2¾ in. diameter.



Sectional view and end view of the spindle end, showing the method of application of the bolted adapter

For metric arbors the symbol is preceded by the letter

"M" and the diameter is given in millimeters, thus: M25B 30-4 = metric arbor 25 m/m dia. Style B, 30 in. long with bearing 2⅛ dia. Shell end mill, or Style C arbors, made to accommodate the proposed new standard shell end mills have two variables, the diameter and the distance from the face of the spindle to the back of the cutter. These two variables enter into the symbol, thus: 1½C ⅞=shell end mill arbor 1½ in. dia. with a projection of ⅞ in. from end of the spindle to the back of the end mills.

While it is expected that standard shell end mill arbors of any one diameter will be kept in stock with only one distance from the end of the spindle to the back of the cutter, the symbol allows special arbors to be ordered without confusion.

The committee feels that while the above selected lists of arbors will cover the requirements of most manufacturers and users, it may be desirable for some manufacturers to carry other lengths in stock, such as short stub arbors for vertical machines, while other manufacturers will not care to carry all sizes in stock. The numbering system therefore has been made flexible enough to allow for its use on sizes other than standard, thus: 1½B 3½ = plain arbor 1½ diameter, 3½ long shoulder to nut, with no bearings. Two types of adapters are shown: one fitting into the taper hole of the spindle and held in with the draw-in bolt, which can be used for end mills and collets with a tang drive; the other type, which registers over the outside of the spindle end and is bolted to the spindle face, can be used for arbors, end mills or other tools having a threaded hole for the draw-in bolt.

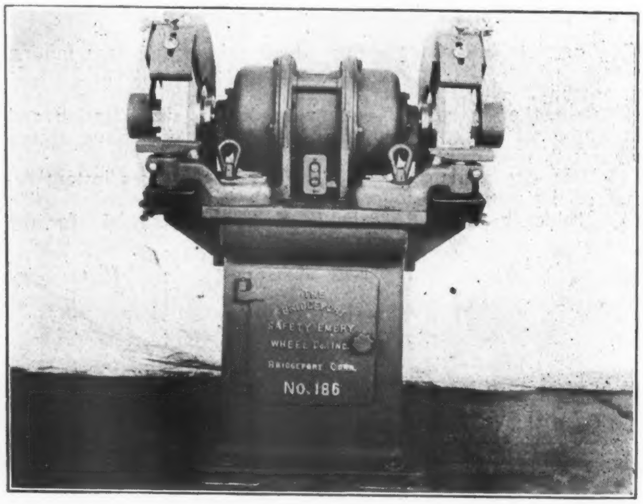
Motor driven double end floor grinder

GENERAL utility floor grinders designed to operate under all kinds of working conditions are now being manufactured by the Bridgeport Safety Emery Wheel Company, Bridgeport, Conn. The machines are driven by General Electric squirrel case type motors which will regularly take an overload of 25 per cent with a temperature rise of not over 55 per cent. The machines are also provided with automatic starters, overload and undervoltage protection and push button control.

The ball bearings on which the spindles operate are locked by individual lock nuts. The bearing housing seals are so designed as to retain the oil and exclude grit and foreign matter. The bearing housings contain an oil bath in which the bearings run. This bath maintains a continual supply of lubricant for a considerable period of time and is replenished by a sight level oil cup.

The wheel guards are made from steel plate of sufficient thickness as to provide adequate protection against wheel breakage. An adjustable nose protection piece is provided. A nozzle is provided at the rear of the machine for connection to an exhaust system. The outside plates of the guards are hinged in order to facilitate the ready change of the wheels.

These machines are made in three sizes driven either by a 2-hp., 3-hp. or 5-hp. motor and provided with 12-in. by 2-in., 16-in. by 2½-in. and 18-in. by 3-in. grinding wheels, respectively.

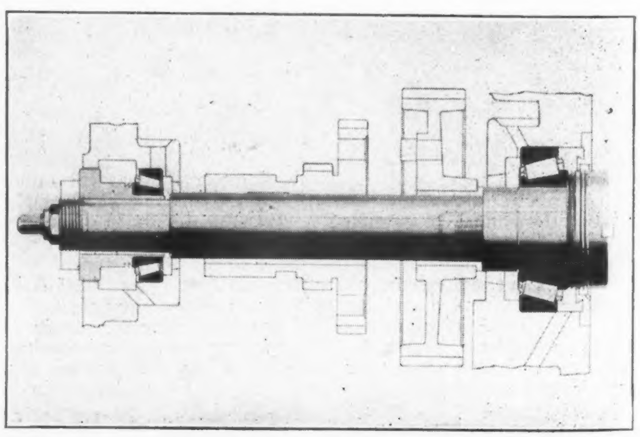


A Bridgeport double end, motor driven, floor grinder provided with two 18-in. by 3-in. grinding wheels

Timken bearing milling machine spindles

FOLLOWING several years of experimental work which included the constant operation since October, 1921, of a milling machine in which the main spindle was equipped with Timken tapered roller bearings, the Kearney & Trecker Corporation, Milwaukee, Wis., is now regularly furnishing ten models of the larger size Milwaukee milling machines with the main spindles mounted in these bearings. The new application is additional to the several Timken bearings used in the gear train leading up to the spindle. The advantages claimed for the use of Timken bearings over plain bearings include greater rigidity and accuracy, increased thrust capacity, permanent alinement and longer bearing life.

In a speed test recently conducted on a main spindle running in Timken bearings, a variable-speed motor was connected directly to the shaft below the spindle, so that the drive was through gears as in normal operation. It



Milwaukee milling machine spindle equipped with Timken bearings

was possible to run the spindle at a speed as high as 2,600 r.p.m. continuously for eight hours. For testing the thrust capacity, a 1 9/64-in. high-speed drill was mounted in the spindle and by using the cross-feed table travel, was fed into S. A. E. 1020 steel at the rate of 9 in. per minute.

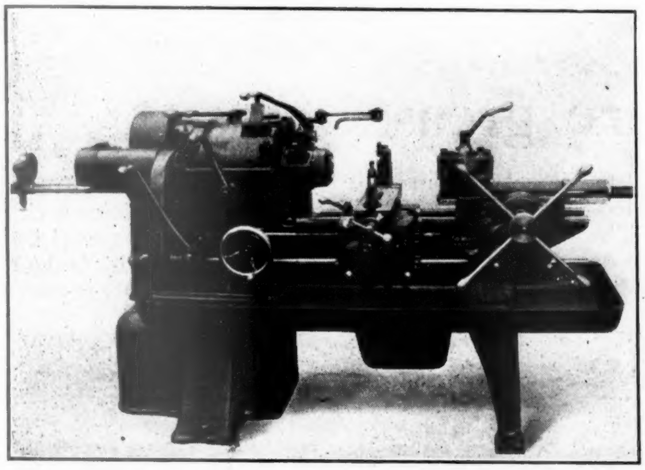
From the illustration, it will be seen that the cone or inner race of the large roller bearing at the front of the spindle is pressed solidly on the spindle and that the cup or outer race is pressed directly into an opening in the column front. Lubricating oil flows constantly in at the rear of the bearing and is returned to the column from the pocket at the front. Oil slingers prevent the escape of the lubricating oil and the entrance of cutting compound into the bearing of the drilling machine spindle.

The cup of the rear bearing is also pressed directly into the column casting, while the cone is pressed on a long sleeve which is keyed to the spindle. This sleeve can be adjusted endwise by means of the nut on the rear end of the spindle.

Unlike the Timken tapered bearings used in automotive practice, these bearings are given an initial thrust load when being adjusted at the factory, thus insuring efficient operation of the spindle without further adjustment for a long period of time. In running the spindle, the bearings become slightly tighter at high speeds. This, however, is never enough to load the bearings excessively, when the spindle is first properly adjusted.

No. 4 turret lathes with power feed cross slide

THE Warner & Swasey Company, Cleveland, Ohio, has recently announced a new model of the No. 4 turret lathe embodying improvements in design and equipment. This machine is designed for 1½-in. by 10-in. bar capacity and for 8-in. swing chucking work.



Warner & Swasey No. 4 turret lathe with six-speed all-geared head, equipped with power-feed cross slide

The new No. 4 turret lathe is now available in three types of head; the six-speed all geared head, the six-speed cone head or the 12-speed all geared head. This machine may be equipped with either a plain screw-feed cross slide or it may also be equipped with a power-feed cross slide. In the power-feed cross slide, six power cross feeds are provided. These six feeds are obtained by levers mounted on the carriage apron and are convenient for the operator to reach. The longitudinal feed is controlled by a hand wheel, mounted on the front of the machine, near the head end. A round tool post is provided on the front of the power-feed cross slide carriage and a holder for a cutting off tool is used on the rear of the carriage.

When the plain screw-feed cross slide is furnished, both the cross feed and the longitudinal feed are operated by separate hand wheels. The hand wheel for the longitudinal feed is mounted at the front end of the turret lathe near the head end and the wheel for the cross feed is at the front end of the screw feed carriage. The tool post equipment is the same as that furnished on the power-feed cross slide.

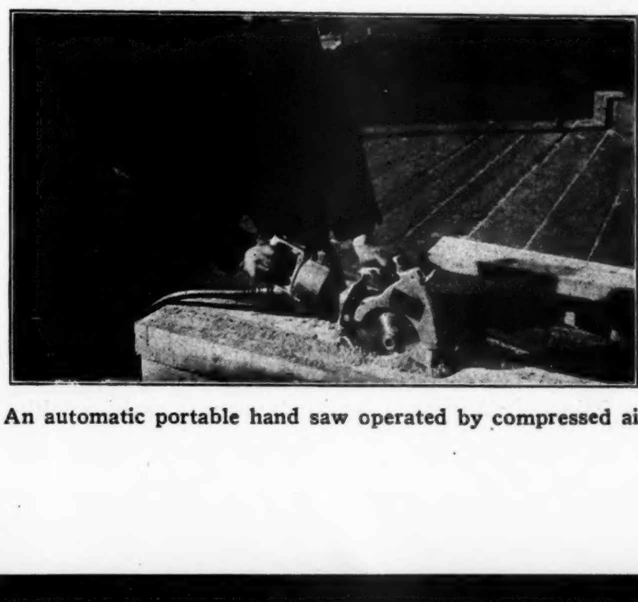
Air-driven portable hand saw

AN automatic portable handsaw, operated by compressed air is now marketed by the Ingersoll-Rand Company, 11 Broadway, New York. By a shift of the blades, the pneumatic handsaw may be used in sawing wood, Bakelite, wallboard, cables, copper, and other materials. Cross-cut or rip blades for different types of work are available.

In sawing wood, it is said that the portable air-driven handsaw can be operated twenty times as fast as a workman can ply his saw and that it can be operated continuously without fatigue to the operator. Its weight is such that it can be easily carried about and handled by the workman. The 8-in. machine weighs 23 lb.

The design combines the Ingersoll-Rand 3-cylinder type air motor with the Crowe safety saw guard which is of a telescopic nature. It opens when the saw is applied to the material and automatically closes and locks in position as the cut is completed. It affords complete protection against accident or damage to the blade. The saw guard has an adjustable stop so that the saw can be set for the required depth of the cut.

The 3-cylinder air motor is of the balanced type and smooth running. All wearing parts, including the cylinders, are renewable. The saw is being manufactured in three sizes, known as B6, B8, and B12, which take 6-in., 8-in., and 12-in. blades, respectively.

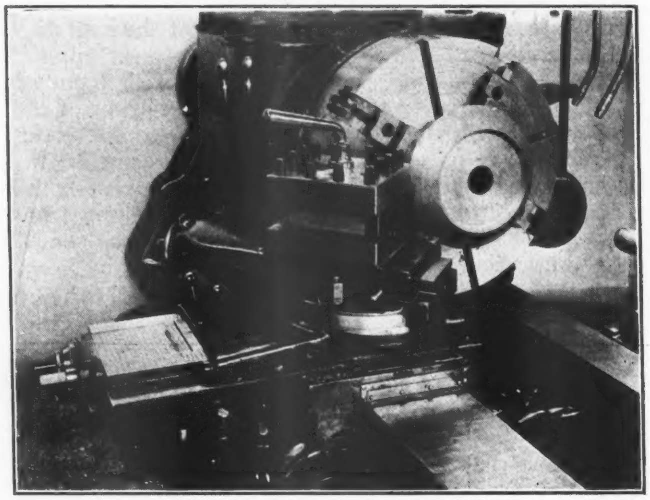


An automatic portable hand saw operated by compressed air

Compound tool slide with power angular feed

THE Gisholt Machine Company, Madison, Wis., has completed a design of compound slide with power angular feed for use on its 3L, 4L and 5L geared head turret lathes. The slide is primarily intended for machining steep taper work. The slide will swivel through the full 360 deg., giving power feed to the tool in any horizontal direction. The upper slide has 6 in. travel on the 3L, and 9 in. on the 4L and 5L turret lathes. The square turret tool post can be used to turn or face diameters up to the full swing capacity of the machine.

The compound feed and cross feed, each having both power and hand feed, are operated entirely independent of one another and have graduated index dials. The power feed to the cross feed slide is automatically disengaged when the power feed to the upper slide is engaged. The number and range of feeds are the same as the longitudinal feeds of the side carriage. The compound slide tool post is not a single purpose unit for it also can do the same work as is done with the standard tool post.



Compound slide with power angular feed for use on Gisholt turret lathes

Spee-d high pressure grease guns

THE construction and the method operation of the Spee-d high pressure grease gun, for filling locomotive rod cups, made by the Reliance Machine & Stamping Works, Inc., 900 Tchoupitoulas street, New Orleans, La., were described on page 569 of the September, 1926, issue of the *Railway Mechanical Engineer*. Since then, the company has brought out two additional grease guns known as the Junior terminal gun and the Junior road gun which are characterized by their light weight.

The terminal grease gun weighs about 6 lb., is less than 7 in. high and the length over all is about 16½ in. A pressure of 5,000 lb. can be obtained with this gun. The swivel top allows the lever to be turned in any position desired when operating the gun, thus permitting the filling of all grease cups in almost any position without moving the locomotive. An engaging handle is provided for attaching and locking the gun on the filler-neck.

Spee-d high pressure road grease gun

The Junior high pressure road gun, which is used by the engineman on the road, weighs about 4 lb., is less than 5 in. high and the lever is 16 in. long. A pressure of 5,000 lb. is also obtainable with this gun. The method of operation differs with the terminal gun in that no extension lever is needed to exert the pressure.

Spee-d Junior high pressure terminal grease gun

EXHAUSTERS.—Bulletin No. 303, descriptive of planing mill exhausters of the slow speed low power type, has been issued by the B. F. Sturtevant Company, Hyde Park, Boston, Mass. These slow speed exhausters are particularly adapted for collecting and conveying shavings, sawdust, chips, dust from emery and buffing wheels and similar materials that can be conveyed in a current of air. A general performance table gives the proper size of fan, speed and horsepower can be determined for the average medium size exhaust installation without the necessity of complicated mathematical calculations.

Betts car wheel boring and facing mill

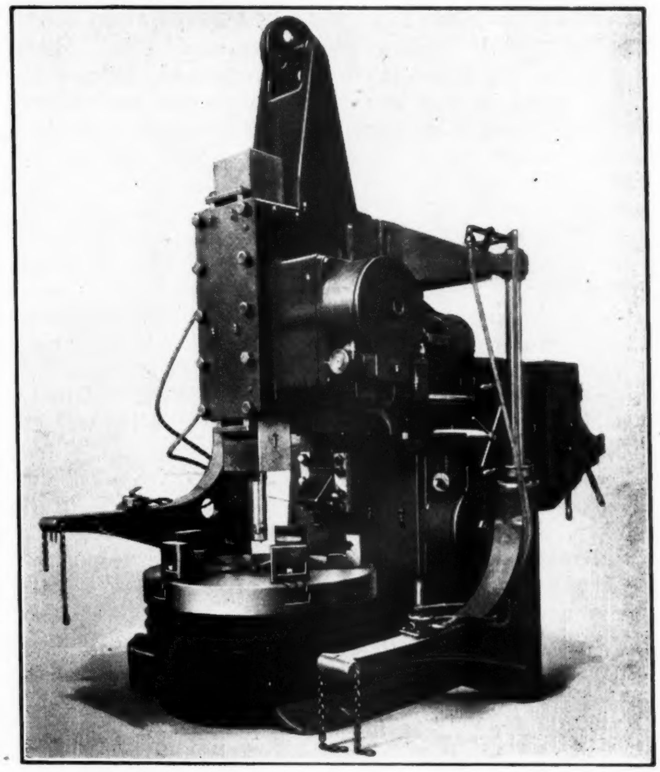
THE illustration shows a recent design of a car wheel boring and facing machine recently developed by the Betts Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y. The machine is intended for rough boring and facing the hubs of steel wheels ranging from 20 in. to 42 in. in diameter.

The chuck is 52 in. in diameter, fully automatic in its action and is equipped with five extra heavy jaws designed to accommodate the chucking of wheels with flanges either up or down. The chuck is driven by a spur gear and pinion of wide face and coarse pitch. The main drive is by a 50-hp. variable speed motor of 3 to 1 speed range having an automatic push button control and dynamic braking for quick stopping.

The vertical boring spindle is made of steel of heavy rectangular section with square guides and shoes for taking up the wear. It is counter-weighted by means of a weight which enters a chamber in the frame when the spindle is elevated. The horizontal facing spindle is also made of steel of heavy rectangular section and is provided with a sliding support in a square guide so that the tool is always backed up rigidly close to the cut. The tool holder has sufficient hand adjustment for easy setting of the tool.

Both boring and facing spindles have a suitable range of power feeds through sliding steel gears. The boring and facing spindles both have power rapid traverse, a separate motor furnishing the power. The power traverse is so arranged that the feed may be used on one spindle while power traverse is being used on the other and vice versa.

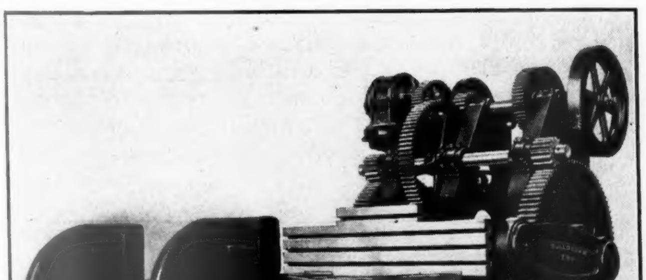
Two pneumatic hoists are used for handling the wheels to and from the chuck. This arrangement allows wheels to be loaded and unloaded from either side of machine. Each hoist swings to the center of the table.



A car wheel boring and facing machine served by two pneumatic swing hoists

Bulldozer designed for the steel car shop

A BULLDOZER, designed for use in steel car shops for bending such parts as arch bars and other members of heavy truck frames, roof purlins and diaphragms, is now manufactured by Williams, White & Company, Moline, Ill. The features of this machine are its large die space, its long stroke and the fact that its die space is accessible from three sides. The crosshead, or moving member, has a stroke of 28 in. and the die space, that is, the distance from the end lugs to the face of the crosshead when the crosshead is in its forward position, is 72 in. The width over the ways is 84 in. The face of the crosshead is 20 in. high at the ends and 32 in. at the center, and is 108 in. long The crosshead is provided with tee-slots for attaching the dies. There is also a tee-slotted die plate between the ways. The machine weighs, complete, 110,000 lb.



The clutches of the Williams-White No. 29-U bulldozer are arranged for electrical control

The principal members are of cast iron. The ways of the bed are protected by hard steel wearing plates. Removable cast iron wearing plates are provided for the bottom of the crosshead. The 20-deg. stub form of tooth is used in all the gears. The company's standard bulldozer friction clutch is used for both the forward and reverse drive. The machine is direct driven by a 75-hp. General Electric motor.

The shifting of the heavy clutches in starting and stopping a machine of this size has required considerable manual effort. The bulldozer shown in the illustration is arranged for electrical control by means of a drum type controller and reversing motor, with suitable relays. The controller is mounted on a portable pedestal which is attached to the machine by a flexible cable so that it can be placed to suit the convenience of the operator. The control is very sensitive as it is possible for an opera-

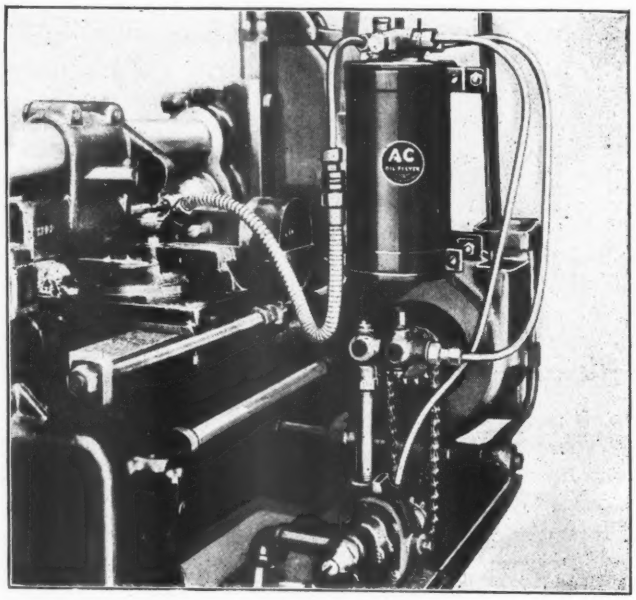
tor to "inch" the crosshead forward or backward in very much the same manner as by hand controlled clutches. This feature has been found very desirable for setting dies.

Oil filter for machine tools

THE A C Spark Plug Company, Flint, Mich., has made available an industrial oil filter developed after a series of experiments on machine tool equipment in its own plant. The constant demand for fine finish led to investigations which showed that dirt, grit and chips in cutting compounds was the direct cause of poor finish and eccentric work. Grit and chips sticking to chuck jaws was found to cause wide variations in accuracy and finish, causing eccentricity and chatter finish. Several installations of A C filters were made to eliminate dirt and grit from cutting compounds and coolants and an improvement in accuracy and finish, together with an increased life of cutting tools and grinding wheels, was said to have resulted. These filters are also adapted to the filtration of lubricating oil for machine bearings.

These oil filters are so designed and installed that when they become filled with the dirt removed from the oil, a new replacement cartridge can be installed with a minimum of idle time for the machine. These filters are now being used to handle lubricating oil and cutting compounds on various machine tools as follows: Centerless grinders, gear cutting and hobbing machines, thread-cutting and thread-rolling machines, swaging and burnishing machines and large and small automatics.

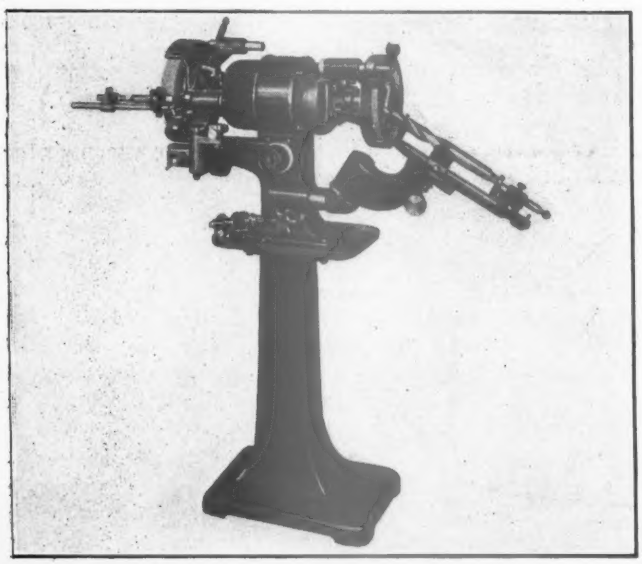
Filtering capacity is made to suit conditions by using banks of several filters connected in multiple. Smaller machines require but one filter. These type filters are supplementary to present and existing installations of sediment tanks and strainers. A typical installation is shown in the accompanying illustration.



Typical installation of oil filter used to remove chips and dirt from cutting lubricant

Combination twist drill and tap grinder

A COMBINATION twist drill and tap grinder manufactured in four sizes and furnished either belt driven or with direct motor drive has been recently developed by the Gallmeyer & Livingston Company, Grand Rapids, Mich. But one adjustment is necessary and that is of the tailstock to accommodate the length of the drill being ground. No adjustment of the lip rest is required and neither is it necessary to make an adjustment when changing from grinding one diameter drill to another or when changing from grinding straight shank or taper shank drills.



Motor driven combination tap and drill grinder

The drill is held in the holder with one hand while with the other hand the tailstock is brought up into position and clamped. The drill holder is automatically placed in the correct position with relation to the grinding wheel. Because of the patented holder stop working in connection with the diamond trueing device, it is said to be impossible to get the holder so close as to damage the lip rest.

In the tap grinding feature, a mechanism is provided for grinding the taper at the end of the tap and the clearance back of the cutting edge thus formed. This taper may be long as in nut taps, short as in plug taps, or very slight as in bottoming taps. The principle remains the same in each case and every flute will have exactly the same taper angle and just enough clearance so that it will cut freely, without weakening its cutting edge.

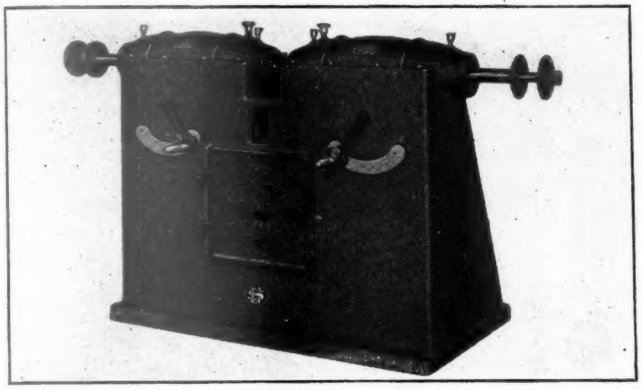
The convex clearance provided for the grinder is in the form of circular arc, struck from a point on a radius laid out at a predetermined angle, in relation to the radius which forms the cutting face of the flute.

A diamond trueing device and diamond are provided for each wheel so that the diamond is always in the

proper position. A repulsion induction type motor built into the head of the machine forms an integral part of the grinder. The armature shaft carries the grinding wheels. Special motor end bells carrying heavy ring oiled phosphor bronze bearings replace those usually supplied with the motor.

Selective-speed buffing and polishing machines

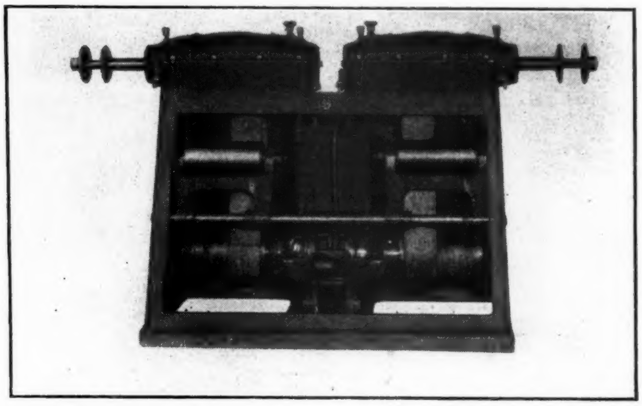
SPINDLE speeds of 2,750 and 2,250 r.p.m. are obtainable in the selective-speed buffing and polishing machines now being manufactured by the United States Electrical Tool Company, 2488-96 West Sixth street, Cincinnati, Ohio. The motor is placed in the machine base and drives the two spindles through



Selective-speed motor-in-the-base buffing and polishing machine

separate belts. It is possible to stop either spindle independently by operating levers, which shift either belt from the driving to the idle pulley and vice versa.

The tension of each belt is constantly regulated by a steel roller, both of these rollers being visible in one of

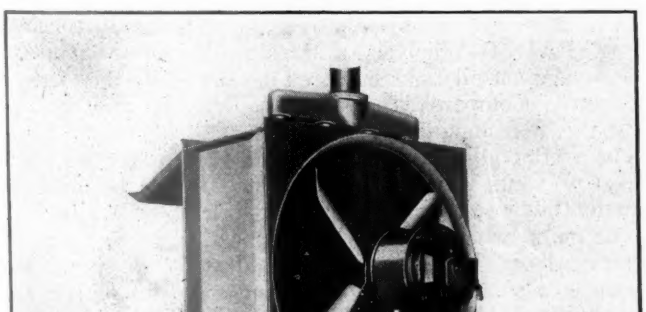


Rear view, showing the drive to the two spindles

the illustrations. The rollers eliminate the necessity of intermittent adjustment to increase the tension. Each machine is equipped with fourteen ball bearings, chrome-nickel steel spindles, and an automatic push-button control. The machines are built in five sizes, of 3, 5, 7½, 10 and 15 hp. capacity, respectively.

Unit heater for shop buildings

THE radiator of the unit heater manufactured by the Herman Nelson Corporation, Moline, Ill., is of the extended surface type, but differs from others in that the core or steam way is of a special alloy cast in one piece. This gives it the durability advantages of a cast iron radiator and the space and weight saving of non-ferrous radiators.



Assembly of the Heiman Nelson Model 20 unit heater

The radiator consists of a one piece cast core upon which aluminum fins are wedged and held in intimate metal to metal contact by spring action. There are no congested steam or water ways in the core to create air pockets, stoppages or excessive resistances.

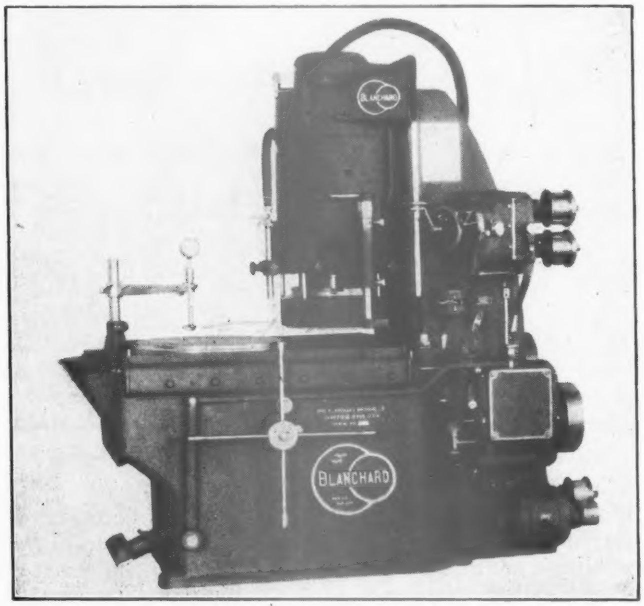
The Model 20 unit heater, complete with motor and deflector, weighs approximately 170 lb. and occupies 4 cu. ft. of overhead space. At 1,150 r.p.m., each unit will deliver in excess of 2,000 cu. ft. per minute; at 850 r.p.m. it will deliver in excess of 1,200 cu. ft. per minute.

The unit will operate on any steam pressure from atmosphere to 125 lb. Operating at 1,150 r.p.m., with the inlet air at 50 deg. and steam pressure at 5 lb., it will deliver the equivalent of 560 sq. ft. of radiation. The same unit with the inlet air at 50 deg. and with 100 lb. working steam pressure will deliver the equivalent of 960 sq. ft. of radiation. Each unit may be automatically or manually controlled without reference to any other unit. The standard unit may be installed to recirculate and heat room air—or it may be installed to take outside air and heat it—or may be installed so that either outside or inside air may be heated.

Elesco locomotive superheaters.—A Spanish translation of the fourth American edition (published in 1925) of its instruction book, covering the installation, operation, maintenance and repair of Elesco locomotive superheaters, has been prepared by The Superheater Company, New York, for distribution in Spanish-speaking countries where superheaters of this type are used.

Changes in Blanchard vertical surface grinder

A RECENT improvement made by the Blanchard Machine Company, 64 State street, Cambridge, Mass., in its No. 16 surface grinder is the new base which has a larger water capacity and also a longer bearing on the floor, although the overall length is increased only 2 in. The new base holds over 100 gallons



The standard No. 16 Blanchard surface grinder is equipped with a 26-in. magnetic chuck and a caliper attachment

of coolant, as compared with 65 gallons in the old base. This additional capacity helps to keep the work and machine cooler on heavy grinding. The treadle shaft is neatly housed in the end of the base. The other end of the base, under the column, is carried straight down to the floor instead of being undercut. These changes improve the appearance and distribute the weight over a larger floor area, without appreciably increasing the space occupied. The motor connections, formerly in a box on the back of the base, are now inside the column, but easily accessible.

General purpose drilling machine

THE conventional design of sensitive drilling machines has been avoided in the "Little General" machine manufactured by Joseph T. Ryerson & Son, Inc., Chicago, Ill. The machine is designed to meet the needs of general shop and tool room service. Its wide range of speeds can be readily adapted also to production work when required. With straight shank drills, it has a drilling capacity of ½ in. By using turned-down shanks, it is possible to drill a 1-in. hole in brass or, with care, in cast iron.

The drive is effected through vee-disks which are made of fibre and tapered to an angle of 18 deg. They mesh with grooves disposed at a corresponding angle, giving a positive friction drive. A direct-reading, speed-shift dial indicates each of the eighteen speeds and the size of drill best adapted to the various materials.

The spindle swings in a complete circle around the column, thus enabling the operator to reach large and heavy pieces in any direction. The table also swings in a semi-circle and both the table and the head have large vertical adjustments.

Other advantages claimed for this drill are: The long

The spindle of this drilling machine swings in a complete circle around the column

reach from the drill to the column; the small number of levers and working parts; the accurate depth gage graduated in both inches and millimeters, and the quick and convenient provisions for shifting and adjusting the spindle that reduce the set-up time to a minimum.

Paint for sealing joints against leaks

A PAINT which is said to seal joints effectively against oil leaks has been developed by the General Electric Company, Schenectady, N. Y., and is sold by the Merchandise Department at Bridgeport, Conn. The product, known as G-E No. 880 red protective paint, also prevents water and gas leaks. It can be used for many purposes which require red lead or white lead. The paint, which is dark red in color, requires no priming and can be applied by brushing or dipping. Denatured alcohol is used as a thinner. It dries rapidly and produces a hard, smooth, glossy film which is easily cleaned and which prevents excessive collection of dirt and conducting material, thereby decreasing surface leakage and subsequent carbonization of the surface when used with electrical apparatus.

PNEUMATIC RIVETERS.—General information on the art of riveting is contained in bulletin R-206, being distributed by the Hanna Engineering Works, Chicago, Ill. An anatomical chart of the Hanna riveter is shown.

News of the Month

THE BLACKSMITH SHOP, tool shop, and brass foundry at the Burnham shops of the Denver & Rio Grande Western at Denver, Colo., were damaged by fire to the extent of $25,000 on February 23.

THE NORTHERN PACIFIC has granted shopmen an increase in pay of two cents an hour for men receiving from 41 to 80 cents an hour and one cent for those receiving 80 cents or more.

APPRENTICES OF THE UNION PACIFIC at the Albina (Oregon) shops, tore down and rebuilt a locomotive in 30 days and rebuilt and repaired two steel freight cars in four days, in the first attempt the Union Pacific has made to use an entire force of shop apprentices in such a job. The apprentices celebrated the completion of the work on March 10 with ceremonies that included a christening of the locomotive.

Shops burned

The shops of the Louisville & Nashville at Boyles, Ala., were damaged by fire on March 16 to the estimated extent of $100,000. The flames are said to have been started by a motor in the planing mill. The shops of the Western Maryland at Elkins, W. Va., were damaged by fire on March 17; estimated loss, including 21 new freight cars, $200,000.

Hyatt bearings on the St. Paul

A passenger coach on the Chicago, Milwaukee & St. Paul, the six-wheel trucks of which are equipped with Hyatt roller bearings, is reported to have made 300,000 miles since the roller bearings were applied. A recent examination of the bearings is said to have shown them to be free from wear or other signs of deterioration. On the basis of the condition of the bearings at the present time, it is estimated conservatively that they will make 600,000 miles. The coach is in service between Chicago and the Pacific Coast, making a round trip every nine days.

Locomotive fuel record, 1926

Class I railroads in 1926 consumed 101,007,549 tons of coal as fuel for road locomotives at an average cost of $2.63 a ton or a total of $266,054,143, according to the Interstate Commerce Commission's monthly statement; consumption in the previous year 97,404,200 tons; average $2.71 and total cost $263,758,941. In 1926 the railroads also consumed 2,067,272,099 gallons of fuel oil at an average cost of 2.95 cents a gallon, as compared with 2,067,048,551 gallons at an average cost of 3.14 cents in 1925. The cost of coal ranged from $1.83 in the Pocahontas region to $4.58 in the New England region.

Prizes for best papers on arc welding

The Lincoln Electric Company, Cleveland, Ohio, will award, through the American Society of Mechanical Engineers at its 1928 spring meeting, prizes totaling $17,500 for the three best papers submitted in a competition on arc welding, the purpose of which is to encourage improvements in the art, the pointing out of new and wider applications of the process, or the indicating of advantages and economies to be gained by its use. The competition, which will close on January 1, 1928, is open to anyone in any country of the world. The rules governing it may be obtained from Calvin W. Rice, secretary, American Society of Mechanical Engineers, 29 West Thirty-ninth street, New York. The prizes are $10,000, $5,000 and $2,500, respectively.

The twelve-hour day on the D., T. & I.

The 16-hour law, says the D., T. & I. Railroad News, is being successfully replaced on the Detroit, Toledo & Ironton by a 12-hour law. The Government-regulated maximum daily period in train or engine service has been fixed at 16 hours for the past 20 years; but on the D., T. & I., for the past two months, this 16-hour law has been operating very satisfactorily in a 12-hour guise. And every effort is being made to bring the maximum workday down to eight successive hours out of every 24, for all employes irrespective of their duties.

The few violators of the "12-hour rule" in the past two months have been relieved of their work on the road in the same manner as is customary when the 16-hour law is in danger of being broken. Studies of the working of the new rule indicate that the 12-hour maximum has a tendency to accelerate the work of individuals.

Frisco to move shops to Yale, Tenn.

The mechanical department facilities maintained by the St. Louis-San Francisco at Harvard, Tenn., and Memphis, are to be discontinued and re-established at Yale, Tenn., six miles southeast of Memphis, where $1,450,000 will be spent in enlargements and improvements. Preliminary work has already begun with the sinking of two 500-gallon-per-minute wells. During 1927 about $750,000 will be spent on the erection of power houses, a roundhouse, machine, boiler and blacksmith shops, a storehouse, two coal chutes, with electrically driven conveyors, a mill shop and several car yard buildings. The power house will have two 450-hp. boilers. It is expected that two years will be required to complete the work.

The car building program at Yale for 1927 includes the construction of 600 new coal cars, the conversion of 200 coal cars into flat cars, and the reinforcing and modernizing of 200 coal cars.

Special train to Montreal convention of Mechanical division

Special cars and, if necessary, special trains will be provided for the accommodation of members of the A. R. A. Mechanical division from Chicago and west desiring to go direct to Montreal, Que., for the annual convention next June. The route will be via the grand Trunk, trains leaving Chicago at 5:30 p.m. on both Saturday and Sunday, June 4 and 5, and arriving at Montreal at 5:00 p.m. Sunday and Monday, June 5 and 6.

Special sleeping cars will be provided and, if enough are required, run as a separate section of the International Limited. There will be several compartment cars as well as open section sleepers. In order that the railroad may be enabled to provide sufficient and proper equipment, reservations for space should be made early to C. G. Orttenburger, general western passenger agent of the Grand Trunk, 108 West Adams street, Chicago.

Meetings and Conventions

The car department officers and supervisors in the southwestern territory on December 18 organized the Southwest Master Car Builders and Supervisors Association. Although permanent headquarters have not yet been established, the association is growing rapidly and had approximately 135 members at the end of February. The last meeting was held March

26 at the Youree Hotel, Shreveport, La. The officers are as follows: President, A. C. Wilson, general car inspector, Missouri Pacific Lines; first vice-president, J. R. Hayden, assistant superintendent car department, Missouri-Kansas-Texas; second vice-president, P. H. Mitchell, general car inspector, Texas & Pacific; third vice-president, E. H. Weigman, master car builder, Kansas City Southern, and secretary-treasurer, B. B. Parker, traveling car foreman, St. Louis Southwestern, Tyler, Tex.

Annual meeting American Welding Society

The eighth annual meeting of the American Welding Society will be held in the United Engineering Societies building, 33 West Thirty-ninth street, New York, April 27, 28 and 29. At the morning session Wednesday, April 27, the reports of the Committees on Gas and Electric Arc Welding will be read. The American Bureau of Welding will meet Wednesday afternoon. Following the report of the Tellers Committee on Thursday, there will be a symposium on research activities in the welding field during the past three years and a symposium on production welding. The Board of Directors of the society and the Joint Pressure Vessel Committee will meet on Friday, April 29.

Car men advance convention date

The annual convention of the Railway Car Department Officers' Association, formerly the Chief Interchange Car Inspectors' and Car Foremen's Association, will be held at the Hotel Sherman, Chicago, on August 23, 24 and 25, instead of in September as in previous years. The new date is a result of a decision of the executive committee made at a meeting on March 2 and 3. In addition to this change, the committee voted to make the new name of the association (adopted last fall to cover the increased scope of the association's work) officially effective on March 3. Suggestions for subjects for the 1927 convention were considered, special emphasis being placed on the need for more detailed consideration of loading rules.

International Railway Fuel Association to present well balanced program

The International Railway Fuel Association has announced the program for its nineteenth annual convention to be held May 10, 11, 12 and 13 at the Hotel Sherman, Chicago. The program includes speakers from practically every department of a railroad, the work of which has any important relation to the utilization and conservation of fuel. Carl Gray, president, Union Pacific; George Otis Smith, director, U. S. Geological Survey, and Dr. H. Foster Bain, secretary, American Institute of Mining and Metallurgical Engineers, are scheduled to speak at the morning session of the first day of the convention. At the afternoon session A. E. Warren, general manager, Central Region, Canadian National Railways, will present a paper on Operating Factors in Fuel Efficiency; E. E. Regan, general superintendent, New York, New Haven & Hartford, will speak on The Train Dispatchers' Relation to Fuel Economy; T. H. Williams, assistant general manager, Southern Pacific, will discuss Fuel Economies in Long Locomotive Runs, and H. S. Rauch, division superintendent motive power, will talk on The Human Element in Fuel Efficiency. On Wednesday morning, May 11, Walter Barnum, president, National Coal Association, will address the convention for The Coal Industry.

The complete program is as follows:

TUESDAY, MAY 10

Invocation.
Addresses by E. E. Chapman (A. T. & S. F.), president; Carl Gray, president, Union Pacific; George Otis Smith, director, U. S. Geological Survey; Dr. H. Foster Bain, secretary, American Institute of Mining and Metallurgical Engineers.
Operating Factors in Fuel Efficiency, by A. E. Warren, general manager, Central Region, Canadian National.
The Train Dispatchers' Relations to Fuel Economy, by E. E. Regan, general superintendent, N. Y., N. H. & H.
Fuel Economies in Long Locomotive Runs, by T. H. Williams, assistant general manager, Southern Pacific.
The Human Element in Fuel Efficiency, by H. S. Rauch, division superintendent motive power, N. Y. C.

WEDNESDAY, MAY 11

Address for the Coal Industry by Walter Barnum, president, National Coal Association.
Report of Committee on the Preparation of Coal and Fuel Oil, Malcolm MacFarlane (N. Y. C.), chairman.
Report of Committee on Fuel Accounting, Distribution and Statistics, B. A. McDowell (B. & O.), chairman.
Report of Committee on Storage of Coal and Fuel Oil, Glenn Warner (Pere Marquette), chairman.

THURSDAY, MAY 12

Addresses by L. K. Sillcox, general superintendent motive power, C. M. & St. P., and chairman, Mechanical Division, American Railway Association, and F. S. Wilcoxen (Edna Brass Company), president, International Railway Supplymen's Association.
Report of Committee on Locomotive Economy Devices, George E. Murray (Grand Trunk Western), chairman.
Report of Committee on Stationary Power Plants, R. S. Twogood (Southern Pacific Co.), chairman.
Report of the Committee on Firing Practice, J. M. Nicholson (A. T. & S. F.), chairman.

FRIDAY, MAY 13

Fuel Fundamentals, by N. D. Ballantine, assistant to president, S. A. L.
Report of Committee on Diesel Locomotives, L. P. Michael (C. & N. W.), chairman.
Report of Committee on Fuel Stations, L. J. Joffray (Illinois Central), chairman; H. Morris (C. R. R. of N. J.), vice-chairman.
Report of Committee on Fuel Bulletins, P. E. Bast (D. & H.), chairman.
Report of Committee on Co-operation with American Railway Association, Eugene McAuliffe (Union Pacific), chairman.
Report on Representation at International Conference on Bituminous Coal, by W. L. Robinson (B. & O.).
Report of Committee on Co-operation with Railway Accounting Officers Association, B. A. McDowell (B. & O.), chairman.
Report of Committee on Constitution and By-Laws, T. Duff Smith (Canadian National), chairman.
Report of secretary-treasurer.
Election of officers.

Mechanical division announces program for June meeting

The program for the convention of the American Railway Association, Division V—Mechanical, which will be held June 7, 8, 9 and 10 at the Windsor Hotel, Montreal, Quebec, has just been announced. With morning and afternoon sessions during the first three days, the convention will cover as much ground as is covered with the six-day programs at Atlantic City. The program is as follows:

FIRST DAY—JUNE 7

Invocation by Canon Shatford, Church of St. James the Apostle, Church of England.
Welcome—Mayor Martin of the City of Montreal.
Address by Premier King of the Dominion of Canada.
Response by R. H. Aishton, president, A. R. A.
Address, "The Man Problem," by Samuel O. Dunn, editor, *Railway Age.*
Address by L. K. Sillcox, chairman of the Mechanical Division and general superintendent motive power, C. M. & St. P.
Action on minutes of 1926 annual meeting.
Appointment of committees on subjects, resolutions, correspondence, etc.
Unfinished business.
New business.
Report of General Committee.
Discussion of reports on Nominations; Design of Shops and Terminals. Couplers and Draft gears; Specifications and Tests for Materials; Brakes and Brake Equipment; Lubrication for cars and Locomotives.

SECOND DAY—JUNE 8

Addresses by Hon. Frank McManamy, Interstate Commerce Commissioner, and M. J. Gormley, chairman, Car Service Division, A. R. A.
Individual paper on Railway Motor Transport with Particular Reference to the Mechanical Problems, by F. J. Swentzel, mechanical superintendent, New England Transportation Company.
Discussion of report on Automotive Rolling Stock.
Individual paper on Passenger and Freight Car Design, by V. Willoughby, general mechanical engineer, American Car & Foundry Company.
Discussion of reports on Car Construction; Arbitration; Prices for Labor and Materials; Tank Cars; Loading Rules; Safety Appliances (including report from H. A. Johnson, director of research).

THIRD DAY—JUNE 9

Address by A. G. Pack, chief inspector, Bureau of Locomotive Inspection, Interstate Commerce Commission.
Individual paper on Oil Engines for Oil Engine Locomotives, by A. I. Lipetz, consulting engineer, American Locomotive Works.
Discussion of reports on Locomotive and Car Lighting, and Locomotive Design and Construction.
Individual papers on the topic, What is Left That Has Not Been Done to Attain the Maximum Theoretical Return from the Steam Locomotive: From the standpoint of traction, by W. H. Winterrowd, vice-president, Lima Locomotive Works; from the standpoint of combustion, by L. H. Fry, Baldwin Locomotive Works.
Individual paper entitled "A Look Into the Future," by Prof. A. T. Wood, The Pennsylvania State College.
Individual paper on Passenger Cars by G. E. Smart, chief of car equipment, Canadian National Railways.
Election and installation of officers.

FOURTH DAY—JUNE 10

Addresses by A. A. Potter, dean of engineering, Purdue University, and Prof. W. J. Cunningham, Harvard University.
Discussion of report on electric rolling stock.
Individual paper entitled "A Review of Progress in the Development of Mechanical Department in Locomotive Service and the Possibilities of Thereby Reducing Waste and Increasing Power," by Dr. W. F. M. Goss, affiliated member.
Discussion of report on utilization of locomotives.

The first three days' sessions will be called to order at 9:30 a.m. The fourth day's session will be called to order at 9 a.m., and final adjournment is scheduled for 12:30 p.m.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, acting secretary, 165 Broadway N. Y. Next meeting May 24, 25, 26 and 27, Mayflower Hotel, Washington, D. C.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 7, 8 and 9, Hotel Windsor, Montreal.

DIVISION V—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York. Annual meeting May 24, 25 and 26, Palmer House, Chicago.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago. Annual convention, Chicago, August 31, September 1 and 2.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church St., New York.

AMERICAN SOCIETY FOR STEEL TREATMENT.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth St., New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting, Hotel Sherman, Chicago, October 25-28.

BIRMINGHAM CAR FOREMEN AND CAR INSPECTORS' ASSOCIATION.—P. H. Gillean, 715 South Eightieth Place, Birmingham, Ala. Meeting, second Monday in each month at Birmingham, Y. M. C. A. Building.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting April 12, 8:30 p. m. Paper on Oxygen–The Wonder Worker, will be presented by W. H. Ludington, manager of railroad engineering department, Air Reduction Sales Company, N. Y.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Regular meeting second Monday in each month, except June, July and August, Great Northern Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. D. Wiegmar, 720 North 23rd St., E. St. Louis, Ill. Regular meeting first Tuesday in each month, except June, July and August.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Next meeting April 14, Hotel Statler, Buffalo. Paper on car retarding and power operated hump classification yards, illustrated by moving pictures, will be presented by Albert G. Moore, advertising manager, General Railway Signal Co., Rochester, N. Y. The Limited cut-off engine will be discussed by Harry D. Vincent of the Franklin Railway Supply Company at the May 12 meeting.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—(See Railway Car Department Officers' Association.)

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 811 Union Central Building. Regular meeting second Tuesday February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month, except July, August and September at Hotel Hollenden, East Sixth and Superior Ave., Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting Hotel Lafayette, Buffalo, N. Y., August 16-18, 1927.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—L. G. Plant Railway Exchange, 80 E. Jackson Boulevard, Chicago. Annual convention May 10 to 13, 1927, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn. Annual convention Chicago, September 6-9, 1927.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, New Orleans, La. Meeting third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York. Annual meeting Chicago, May 3-6, 1927.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston. Next meeting April 12. Paper on steel rails will be presented by C. W. Gemret, Jr., representative Robert W. Hunt Co.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately. Next meeting April 13, at University of California, Berkeley. Paper on modern locomotive design and its influence upon railway operation will be presented by W. E. Woodard, vice-president, Lima Locomotive Works. Motion pictures and lantern slides.

RAILWAY CAR DEPARTMENT OFFICERS' ASSOCIATION.—A. S. Sternberg, Belt railway, Clearing Station, Chicago. Annual convention Hotel Sherman, Chicago, August 23, 24 and 25.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meeting third Thursday in January, March, May, July, September and November.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—C. Kimball, Inman shops, Southern, Atlanta, Ga.

TEXAS CAR FOREMEN'S ASSOCIATION.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings first Tuesday in each month, Terminal Hotel bldg., Fort Worth, Tex.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting Hotel Sherman, Chicago, September, 1927.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

The Commonwealth Steel Company, Granite City, Ill., is constructing a shop building 100 ft. by 600 ft. in area.

William T. Kilborn, assistant sales manager of the Graham Bolt & Nut Company, Pittsburgh, Pa., has been appointed general sales manager.

The Mahr Manufacturing Company, Minneapolis, Minn., has removed its New York office to 55 West Forty-second street, New York City.

The Vapor Car Heating Company, Chicago, will move its New York office on or before May 1 to the Park Murray building, 10 Murray street.

George F. Konold, Jr., secretary of the Warren Tool & Forge Company, Warren, Ohio, has been elected president to succeed James D. Robertson, deceased.

E. S. Wortham, sales agent of the Scullin Steel Company, with headquarters at Chicago, has been promoted to vice-president, with the same headquarters.

The New York Air Brake Company has removed its New York office from 165 Broadway to the Graybar building, 420 Lexington avenue, New York City.

H. A. Cronmiller has been appointed eastern representative of the O. M. Edwards Company, Inc., with offices at 412 Broadway, New York City, succeeding A. J. Horgan.

The Chambersburg Engineering Company, Chambersburg, Pa., has opened an office in the Stephenson building, Detroit, Mich. Racine Ripley is manager in charge of that territory.

The Soapless Lubricating Grease Process, as developed by A. L. Nugey, a mechanical and petroleum engineer of New York, has been taken over exclusively by the Swan-Finch Oil Corporation, New York City.

C. V. Lally has been appointed general manager of sales of the Pittsburgh Steel Products Company, Pittsburgh, Pa. Richard R. Harris, who has been general manager of sales of the Pittsburgh Steel Company and subsidiary companies, has resigned.

J. J. Hennessy, for 12 years engineer with the Texas Company, with headquarters at St. Louis and at New York, and for the past three years superintendent of its railway sales division at New York, has resigned to go into other railway sales work, with headquarters at New York.

H. K. Williams, for the past several years commercial engineer in the northeastern district sales office of the Safety Car Heating & Lighting Company, at New York, has been appointed sales engineer, with the same headquarters, reporting to the vice-president in charge of sales.

Curtis B. Friday has been appointed sales engineer of wheels and forgings in the rail bureau of the general sales department of the Illinois Steel Company, Chicago. Norman M. Hench has been appointed sales engineer of track accessories in the rail bureau of the general sales department.

Cecil R. Pilsbury, general auditor of the Commonwealth Steel Company, Granite City, Ill., has been promoted to treasurer. Oliver T. Ledford, assistant to the president, has been promoted to secretary. Frank L. Morey, secretary and treasurer, has resigned. Harrison Hoblitzelle has been elected vice-president and manager of purchases.

F. A. Weymouth, formerly sales metallurgist of the Bethlehem Steel Company, has been elected vice-president of the Burden Iron Company, with headquarters at Troy, N. Y. Mr. Weymouth graduated from the Lawrence Scientific School, Harvard University, in 1906, and for several years served as engineer of tests of the Maryland Steel Company.

An arrangement has been made whereby the axle generator business of the Electric Storage Battery Company has been acquired by the Safety Car Heating & Lighting Company, and hereafter the battery requirements of the Safety Car Heating

& Lighting Company will be furnished by the Electric Storage Battery Company. The Safety Car Heating & Lighting Company will manufacture and furnish to the railroads when required ESB axle equipments and replacement parts. It is now possible for the Safety Car Heating & Lighting Company to meet the car lighting demands of the railroads not only with its standard Safety equipment, but also to furnish the USL and ESB types.

John R. Hayward, Liberty Trust building, Roanoke, Va., succeeds Frank N. Grigg of Washington, D. C., as southeastern railway sales manager of the Heywood-Wakefield Company, Wakefield, Mass. Mr. Grigg has represented the Heywood-Wakefield Company for many years and is now retiring on account of his health.

The Cogan Machine & Foundry Company, Inc., Cleveland, Ohio, will put up a new factory building of brick and steel sash construction at 1440 East Fifty-fifth street. This company's manufactures include railroad plate and coil spring forming and quenching machines and high pressure pump-driven bulldozers and bending machines.

The Gisholt Machine Company, Madison, Wis., recently opened an office at 722 West Washington Boulevard, Chicago, in charge of R. E. MacCartney, who has been special factory representative in the Chicago district for the past year. Mr. MacCartney will be assisted by E. B. Verner, who has served for several years in the home office.

Joseph G. Worker has been appointed general sales manager and elected a director of the American Engineering Company, Philadelphia, Pa. For fifteen years Mr. Worker was associated with the Westinghouse Companies and for the last five years of this period was manager of the stoker section of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa.

R. H. Bourne, formerly vice-president and sales manager of the Whiting Corporation, Harvey, Ill., is now senior vice-president and will devote practically his entire time to the Grindle Fuel Equipment Company and Joseph Harrington Company sales. N. S. Lawrence, formerly vice-president and assistant sales manager is now vice-president and sales manager in charge of sales for Whiting Corporation and Swenson Evaporator Company lines. Mr. Lawrence will be assisted by A. H. McDougall, vice-president and consulting engineer, and R. E. Prussing, vice-president in charge of district offices and agents. The above changes in the sales organization were made on account of the addition of new lines and the acquisition of subsidiary companies.

Maurice L. Sindeband has been elected a vice-president of the American Brown Boveri Electric Corporation, with headquarters at New York and assumed his duties on March 1. Since 1915, he has been in the engineering department of the American Gas & Electric Company and he was recently elected a vice-president of this company in charge of the electrical engineering department. After receiving his education at Columbia University, Mr. Sindeband started his engineering career in 1907 with the New York Central. He was then engaged in station design work for the Brooklyn Edison Company, and in 1915 he entered the engineering department of the American Gas & Electric Company. His rise here was rapid, and he was made electrical engineer in 1918, and later vice-president.

Maurice L. Sindeband

Charles F. McCuen, vice-president and sales manager of W. H. Miner, Inc., who died on February 26, in Pittsburgh, Pa., was born on September 27, 1870, in Pittsburgh. After finishing his school and university courses, he entered the service of the Atlanta & West Point, at Montgomery, Ala. In 1899 he was appointed chief clerk in the motive power department of the St. Louis Southwestern at Pine Bluff, Ark., and in 1905 resigned to become chief clerk to the superintendent of motive power of the Missouri Pacific. In 1911, he entered the employ of the Standard Heat & Ventilation Company, now the Vapor Car Heating Company, and later was a representative of the Bradford Corporation and the Camel Company. In January, 1925, he was elected vice-president and sales manager of W. H. Miner, Inc., Chicago, which position he held until his death.

Hampton Wallace Johnston, service engineer of the Franklin Railway Supply Company, Inc., New York, died on February 22, at Homestead, Fla., at the age of 43, after an illness of several months. Mr. Johnston entered railway service as a special apprentice with the Lake Shore & Michigan Southern, with which road he remained for six years. He then went to the Delaware, Lackawanna & Western as assistant general foreman at the time of starting the new shops at Scranton, Pa. Later he was appointed supervisor of tools of all the shops of that system. He also served as supervisor of tools of the Baltimore & Ohio, reporting to the superintendent of motive power. His work covered the standardization of boiler threads and of methods and tools for the maintenance of boiler flues, arches, super-heaters; and as chief boiler inspector he conducted the examinations of all boiler inspectors. Just previous to his joining the service staff of the Franklin Railway Supply Company, Inc., in June, 1923, he was factory manager for the Wood Turret Machine Company, Brazil, Ind.

Henry Gardner, special engineer of the Baltimore & Ohio, has resigned to become consulting engineer with the Steamotor Company, Chicago, Illinois. He was born in Salem, Mass., June 8, 1873, and graduated from the Massachusetts Institute of Technology in 1896. In that same year he began railroad work as special apprentice in the Boston & Maine shops at Boston, Mass. Later he was appointed shop draftsman and inspector at Concord, N. H., and became assistant master mechanic at Concord in 1904. From 1905 to 1908 he was locomotive designer for the H. K. Porter Company, Pittsburgh, Pa., and chief draftsman of the Pittsburgh & Lake Erie, Pittsburgh, respectively. From 1908 to 1914 he was supervisor of shop systems and supervisor of apprentices of the New York Central Lines at New York City. In 1914 Mr. Gardner left New York to become assistant superintendent of shops on the Baltimore & Ohio at Baltimore. From 1916 to date he held the following positions on that road, respectively: supervisor of material conservation, corporate mechanical engineer and finally special engineer on the staff of the chief of motive power and equipment.

Henry Gardner

The Transportation Equipment Corporation was recently organized, and will establish its office in the new Graybar building, Lexington avenue, New York City. Thomas J. Crowley is president, and Chester B. McLaughlin, Jr., is vice-president and treasurer. The directors include Colonel Douglas I. McKay, president of the Standard Coupler Company. Mr. Crowley is a son of the late Thomas W. Crowley, who was superintendent of the St. Lawrence division of the New York Central; he is also vice-president of the Handlan Buck Manufacturing Company, St. Louis. Mr. Crowley will continue his connection with that company, whose eastern offices are located in the Grand Central Terminal building. Mr. McLaughlin is a member of the law firm of McLaughlin & Royce. Jay Vandergrift, who has been Pennsylvania state distributor for several automobile manufacturers, will direct the sales of the company. Among the im-

mediate activities of the Transportation Equipment Corporation will be efforts to increase in the railway field the use of Duco and other manufactures of the Chemical Products division of E. I. du Pont de Nemours Company.

G. S. Turner, who has been elected president of the T Z Railway Equipment Company, Lytton building, Chicago, recently organized by Mr. Turner, F. G. Zimmerman and F. J. Kearney, was formerly in the mechanical department of the Southern. He was there until 1909 when he entered the railroad sales department of the Crane Company, Chicago, as a salesman and mechanical expert. On September 1, 1913, he resigned to become vice-president of Harry Vissering & Company (now known as the Viloco Railway Equipment Company) and the Charles R. Long, Jr., Company. Later he became vice-president of the Okadee Company and on February 21, 1925, he was elected president and director of the Viloco Railway Equipment Company. When he resigned to organize the T Z Railway Equipment Company he was president and director of the Viloco Railway Equipment Company, vice-president and director of the Okadee Company, the Charles R. Long, Jr., Company, and the Viloco Machine Company.

G. S. Turner

Mr. Zimmerman entered business in September, 1908, in the railroad sales department of the Crane Company. In May, 1916, he entered the employ of Harry Vissering & Company (Viloco Railway Equipment Company) and during his connection with this company he also became associated with the Okadee Company, the Viloco Machine Company, and the Charles R. Long, Jr., Company. At the time of his resignation in January he was vice-president, director and secretary for the Viloco Railway Equipment Company and the Okadee Company, director and secretary-treasurer of the Viloco Machine Company, and also assistant secretary of the Charles R. Long, Jr., Company.

Mr. Kearney entered railway service as a machinist apprentice on the Duluth, South Shore & Atlantic at Marquette, Mich., and in March, 1904, was appointed a machinist at Proctor, Minn. In 1907 he was appointed assistant roundhouse foreman of the Great Northern, with headquarters at Superior, Wis., and in October, 1909, was appointed general foreman, which position he held until 1911 when he was made assistant master mechanic. In 1914 he was appointed roundhouse foreman of engines and in 1916 resigned to become general foreman on the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn. He held the latter position until January, 1925, when he entered the employ of Harry Vissering & Company (Viloco Railway Equipment Company) as a mechanical expert, which position he held until his resignation.

Cut-Off & Speed Recorder Corporation

The Cut-Off & Speed Recorder Corporation, 342 Madison avenue, New York, has acquired an exclusive license to operate under the patents owned by the Distance-Speed Recording Company. In addition, it has acquired by lease from the latter company its machinery and equipment used in the manufacture of the loco recorder and it has also acquired the stock of maintenance and service parts. The Distance-Speed Recording Company and its president, J. E. Matthews, have withdrawn from the manufacture, sale and servicing of "loco" recorders, "loco" valve pilots, etc., thereby retiring from this field. The Cut-Off & Speed Recorder Corporation will also devote its activities to the promotion and sale of the "loco" valve pilot which is a combination of a "loco" recorder with an apparatus and device currently indicating to the engineman in the locomotive cab the position of the cut-off.

Personal Mention

General

James S. Clarke has been appointed general inspector of locomotive maintenance of the Boston & Maine, with headquarters at Boston, succeeding George A. Silva.

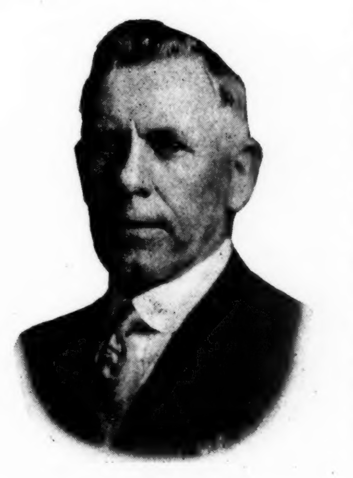
O. E. Ward, superintendent of motive power of the Chicago, Burlington & Quincy, Lines West of the Missouri river, has been transferred to the Lines East of the Missouri river, with headquarters at Chicago, succeeding J. W. Cyr.

Henry H. Wilson, general road foreman of engines of the Boston & Maine, at Boston, Mass., has been appointed assistant to the mechanical superintendent, with the same headquarters, with duties assigned. The position of general road foreman of engines has been abolished.

Henry H. Urbach, assistant superintendent of motive power of the lines of the Chicago, Burlington & Quincy east of the Missouri river, with headquarters at Chicago, has been promoted to superintendent of motive power, Lines West of the Missouri river, with headquarters at Lincoln, Neb., succeeding O. E. Ward.

Samuel Lynn, who has been appointed superintendent rolling stock of the Pittsburgh & Lake Erie, with headquarters at McKees Rocks, Pa., was born on August 2, 1869, at Pittsburgh, Pa., and was educated in the common schools. He entered railway service in 1885 as a laborer for the Pittsburgh & Lake Erie and shortly thereafter became a car repairer and, later, a gang foreman. From 1893 to 1908 he was passenger car foreman at the company's Pittsburgh terminal, and in 1908, he was appointed master car builder at McKeesport. He held that position until the time of his recent promotion.

James Paul, who has been appointed superintendent of motive power of the third division of the Atlantic Coast Line, with headquarters at Tampa, Fla., was born in 1869, in Lanarkshire, Scotland. He received a high school education and entered railroad service in 1885 with a predecessor of the Atlantic Coast Line as a car inspector's helper. Three months later he was transferred to the machine shop as an apprentice and remained there until he had completed his time, when he became an air brake repairman. Later he became enginehouse foreman and still later, general foreman. In 1906, he became master mechanic and in November, 1925, he was appointed assistant superintendent of motive power. He held that position until the time of his recent promotion.



J. Paul

David C. Reid, assistant mechanical superintendent of the Boston & Maine, at Boston, Mass., has been appointed superintendent of locomotive maintenance, with headquarters in the same city, succeeding R. W. Band, assigned to other duties. Mr. Reid was born on April 7, 1890, at Chicago, Ill. He was educated in the public schools at East Chicago, Ind., and entered railroad service in June, 1906, with the Chicago Terminal. For four years he was a machinist appretnice on this road. He then served with the Elgin, Joliet & Eastern from 1910 until 1911, when he left this road to go with the Hubbard Steel Foundry. During 1912, he was in the employ of the Goldschmidt Detinning Company, and then went with the New York Central as a

machinist. Mr. Reid became assistant roundhouse foreman in October, 1917; night enginehouse foreman in November, 1917; day enginehouse foreman in December, 1920; general enginehouse foreman in October, 1922, and assistant mechanical superintendent in April, 1926.

T. W. Coe, who was recently promoted to superintendent of motive power of the New York, Chicago & St. Louis, was born at Norwalk, O., December 4, 1879, and was educated in the high school of that place. Mr. Coe entered the service of the Lake Shore & Michigan Southern (now part of the New York Central) as a machinist apprentice at Norwalk on December 21, 1896, and served a four-year apprenticeship at that point, at the termination of which he was transferred to the Collinwood shops, Cleveland, O., as a machinist. In 1901 he entered the service of the Wheeling & Lake Erie as a locomotive foreman at Dillonvale, O., continuing in that capacity until 1904 when he returned to the service of the Lake Shore as passenger enginehouse foreman at Elkhart, Ind. He was later promoted to night general foreman at Englewood (Chicago) in 1910, returning to Elkhart as general foreman over both passenger and freight enginehouses in November, 1910. In September, 1913, Mr. Coe became superintendent of shops at Elkhart, remaining in that position until March, 1916, at which time he was appointed master mechanic for the Indiana Harbor Belt at Chicago. On November 1, 1917, he was appointed master mechanic at Conneaut, O., for the New York, Chicago & St. Louis, continuing in that capacity until his appointment.

Master Mechanics and Road Foremen

A. R. Sykes, master mechanic of the Missouri Pacific at McGhee, Ark., has been transferred to Van Buren, Ark.

J. J. Maginn has been appointed master mechanic of the New York, Chicago & St. Louis, with headquarters at Conneaut, Ohio.

Arthur Carr has been appointed road foreman of engines of the Southern Pacific, Pacific Lines, with headquarters at Dunsmuir, Cal.

E. H. Doherty has been appointed master mechanic of the New York, Chicago & St. Louis, with headquarters at Lima, Ohio, succeeding J. J. Maginn.

W. G. Fifield has been appointed road foreman of engines of the Coast division of the Southern Pacific, Pacific Lines, with headquarters at San Luis Obispo, Cal.

J. W. Cyr, superintendent of motive power of the Chicago, Burlington & Quincy, Lines East of the Missouri river, has been appointed superintendent of shops, with headquarters at Aurora, Ill.

W. C. Davis has been appointed road foreman of engines of the Stockton Division of the Southern Pacific, Pacific Lines, with headquarters at Tracy, Cal., succeeding G. B. Jefferis, retired.

W. B. Sharp has been appointed assistant road foreman of engines of the Coast division of the Southern Pacific, Pacific Lines, with headquarters at San Francisco, Cal., succeeding W. G. Fifield.

G. W. McGowan, shop superintendent on the Texas lines of the Southern Pacific at Houston, Tex., has been appointed master mechanic of the Houston terminals, including jurisdiction over the Englewood car department.

W. T. Abington, general foreman on the Missouri Pacific, at North Little Rock, Ark., has been appointed master mechanic of the Little Rock division, with headquarters at McGhee, Ark., succeeding A. R. Sykes.

O. C. Wright, road foreman of engines on the Western region of the Pennsylvania at Indianapolis, Ind., has been promoted to master mechanic of the Indianapolis division, with the same headquarters, succeeding W. R. Davis.

J. B. Diven, master mechanic of the Philadelphia Terminal division of the Pennsylvania, at West Philadelphia, has been appointed superintendent of motive power of the Eastern Ohio division, with headquarters at Pittsburgh, Pa., succeeding O. P. Reese.

E. H. Roy, master mechanic of the Seaboard Air Line, Alabama division and that portion of the South Carolina division between Cayce, S. C., and Jacksonville-Baldwin, Fla., excluding Jacksonville and Baldwin, with headquarters at Savannah, Ga., has been appointed general master mechanic of the Western district, with the same headquarters.

Henry Ballenberger, general foreman of the locomotive department of the Seaboard Air Line at Andrews, S. C., has been appointed master mechanic of the East Carolina division, with headquarters in the same city. Mr. Ballenberger was born at Goldsboro, N. C., on November 26, 1884, and, after being graduated from grammar school, began his railroad career in June, 1903, with the Georgetown & Western, Georgetown, S. C., as a machinist. He was subsequently promoted to mechanical foreman. When the Georgetown & Western was merged with the Seaboard Air Line on December 1, 1915, Mr. Ballenberger was appointed general foreman with headquarters located at Andrews, S. C.

H. Ballenberger

Archie W. Turner, who has been appointed division master mechanic of the Michigan Central, with headquarters at Niles, Mich., as was announced in the March issue of the *Railway Mechanical Engineer*, was born on January 14, 1879, in the Township of Dunwich, Province of Elgin, Canada. Mr. Turner entered the service of the Michigan Central in June, 1892, as a water boy and, with the exception of one and one half years spent at college, has been in the employ of that road continuously since that time. He subsequently served as timekeeper for the roadmaster and timekeeper and water boy for an iron bridge erector, in March, 1898, becoming locomotive fireman and in September, 1905, road engineer. In June, 1923, he was promoted to the position of road foreman of engines which he held until his recent appointment as division master mechanic.

A. W. Turner

H. McLendon, who has been appointed master mechanic of the Seaboard Air Line, with headquarters at Savannah, Ga., was born on January 3, 1884, at Americus, Ga. He was a graduate at the Americus high school in 1901, and on January 2, 1902, entered the employ of the Seaboard Air Line as a timekeeper. In October, 1902, he became a machinist apprentice at Americus, and in 1909 was appointed machine shop foreman. He served as machine shop foreman and enginehouse foreman until November, 1916, when he was transferred to Savannah, Ga., as enginehouse foreman. In July, 1917, he was appointed general foreman locomotive department at Savannah, and in August, 1920, transferred to Andrews, S. C., as master mechanic. The position of master mechanic at Andrews was abolished in November, 1920, and Mr. McLendon was transferred to Mon-

roe, N. C., as general foreman, which position he was holding at the time of his appointment as master mechanic of the Seaboard Air Line at Savannah, Ga.

Robert W. Wray, who has been appointed master mechanic of the Pennsylvania with headquarters at West Philadelphia, Pa., entered the employ of the Pennsylvania as a special apprentice on May 1, 1905, after having attended The Pennsylvania State College. In May, 1909, he was appointed motive power inspector at Harrisburg, Pa.; in September, 1911, enginehouse foreman; in August, 1916, assistant master mechanic at Jersey City, N. J.; in July, 1917, assistant engineer motive power; in October, 1918, master mechanic at Baltimore, Md.; and in December, 1921, master mechanic at Renova, Pa.

Bruce M. Swope, who has been appointed master mechanic of the Pennsylvania at Columbus, Ohio, was born on June 13, 1885, at Altoona, Pa. He was a mechanical engineer graduate at Lehigh University in 1907. On July 1, 1908, he entered the service of the Pennsylvania as a special apprentice at Altoona, Pa. In 1912 he was appointed motive power inspector, Conemaugh division, and later served in the same capacity at the Pitcairn car shop, Pittsburgh division. In 1916 he was assigned to special work in the office of the superintendent of motive power, Western Pennsylvania division, at Pittsburgh, Pa. In 1917 he was promoted to assistant master mechanic at Renovo, Pa.; in 1920 to assistant engineer motive power, Lake Division, Cleveland, Ohio; in May, 1923, to assistant engineer motive power, Southwestern Region, office of general superintendent motive power, St. Louis, Mo.; in February, 1924, to master mechanic, St. Louis Division, with headquarters at Terre Haute, Ind., and in November, 1924, to master mechanic, Buffalo division, with headquarters at Olean, N. Y. Mr. Swope was transferred to Columbus on March 1 of this year.

B. M. Swope

Shop and Enginehouse

R. Morris, general foreman of the Missouri Pacific at Atchison, Kan., has been transferred as general foreman to the shops at Falls City, Neb.

J. D. Knox, night enginehouse foreman of the St. Louis-San Francisco at Springfield, Mo., has been appointed general foreman, with headquarters at Kansas City, Mo.

James Grant, general foreman of the Atlantic Coast Line, with headquarters at Port Tampa, Fla., has been appointed shop superintendent of the Tampa, Fla., shops.

W. C. Stephenson, for many years foreman of the machine shop of the Atlantic Coast Line at Emerson, N. C., has been appointed general foreman, with headquarters at Tampa, Fla.

J. J. Mooney has been promoted to general foreman of the Missouri Pacific, with headquarters at Houston, Tex. Mr. Mooney was formerly night roundhouse foreman at Mart, Tex.

J. T. Connor, master mechanic of the Houston division, of the Southern Pacific, at San Antonio, Tex., has been appointed shop superintendent at Houston, Tex., succeeding G. W. McGowan.

P. J. Ketchen has been appointed general foreman of the Chicago, Rock Island & Pacific, with headquarters at El Dorado, Ark., succeeding F. L. Coles, who has been transferred to Biddle, Ark.

George Shepp, general locomotive foreman of the Missouri Pacific at Coffeyville, Kans., has been appointed general enginehouse foreman, with headquarters at Kansas City, Mo.

Fred W. Burch, general enginehouse foreman of the Missouri Pacific at Kansas City, Mo., has been appointed general locomotive foreman, with headquarters at Coffeyville, Kans.

F. L. Carson, assistant superintendent of motive power, of the Southern Pacific at Yoakum, Tex., has been transferred to San Antonio, Tex., with supervision over the shops at that point and all mechanical matters on the Houston division.

George A. Silva, general inspector of locomotive maintenance of the Boston & Maine, at Boston, Mass., has been appointed superintendent of shops, with headquarters at North Billerica, Mass., succeeding Harold L. Leighton, who has been assigned to other duties.

George Henry Logan, general foreman at the Chicago shops of the Chicago & North Western, has been appointed superintendent of shops, motive power and machinery, with headquarters in the same city, succeeding J. Murrin, retired on pension. Mr. Logan, who was born on January 3, 1877, at Chicago, has had a grammar and correspondence school education. He became employed on the Chicago & North Western on July 1, 1892, as a messenger in the Wood street car department, and on January 2, 1894, began his apprenticeship at the Chicago shops. From January 1, 1899, to November 1, 1902, he served as a machinist, erecting and machine side, and on the latter date was promoted to gang boss, erecting floor. In March, 1906, he was promoted to machine shop foreman and in June, 1909, became demonstrator and apprentice instructor. In September, 1909, he was appointed general foreman at Missouri Valley, Iowa; in December, 1913, transferred to Clinton, Iowa, and in November, 1917, transferred to the Chicago shops. During 1924 Mr. Logan was president of the International Railway General Foremen's Association.

G. H. Logan

Car Department

Andrew Craig, division car foreman of the Boston & Maine, at Charlestown, Mass., has retired after 46 years' service.

Malcolm Morrison, division car foreman of the Boston & Maine, at Concord, N. H., has been appointed general inspector, car department, with headquarters at Portland, Maine.

C. A. Dolby, supervisor of inspectors of the Cleveland, Cincinnati, Chicago & St. Louis, at Indianapolis, Ind., has been promoted to car foreman, with headquarters at Springfield, Ohio, succeeding I. H. Staley.

H. F. Derner, general foreman, car department, of the Indiana Harbor Belt, at Gibson, Ind., has been appointed general inspector, car department, of the Boston & Maine, with headquarters at Boston, Mass.

B. F. Orr, district master car builder of the Cleveland, Cincinnati, Chicago & St. Louis, at Indianapolis, Ind., has been promoted to superintendent of shops, with headquarters at Beech Grove, Ind., succeeding J. A. Brossart.

C. C. Sturgess, assistant general car foreman on the Kansas City Southern, with headquarters at Pittsburg, Kan., has been appointed general car foreman, with headquarters at Shreveport, La., succeeding R. L. Burch, deceased.

W. A. THOMAS, foreman of the Cleveland, Cincinnati, Chicago & St. Louis at the Shelby street coach yards, Indianapolis, Ind., has been promoted to general foreman, with headquarters at Brightwood, Ind., succeeding C. N. Kittle.

L. C. GEISEL, general foreman of the freight shops of the Cleveland, Cincinnati, Chicago & St. Louis, at Beech Grove, Ind., has been promoted to district master car builder, with headquarters at Indianapolis, Ind., succeeding B. F. Orr.

J. A. BROSSART, superintendent of car shops of the Cleveland, Cincinnati, Chicago & St. Louis, at Beech Grove, Ind., has been appointed general master car builder, with headquarters at Indianapolis, Ind., succeeding I. S. Downing, deceased. Mr. Brossart was born on May 15, 1883, at Aurora, Ind., and after the completion of a high school education entered railroad service as a piecework inspector at the Brightwood, Ind., shops of the Big Four, May 10, 1903. During the period to December 1, 1910, he served as piecework inspector and gang foreman. On the latter date he was promoted to the position of general shop inspector, serving in this capacity until August 20, 1913, when he became freight car foreman at the Beech Grove shops. From April 1, 1914, to March 1, 1925, Mr. Brossart held the position of general passenger car foreman at the Beech Grove shops, and on the latter date was promoted to superintendent of shops, car department.


J. A. Brossart

WILLIAM C. LANG, who has been appointed master car builder of the Pittsburgh & Lake Erie, with headquarters at McKees Rocks, Pa., was born on January 5, 1881, at Cochranton, Pa. He was educated at the State Normal School at Edinboro, Pa., graduating from there in 1900. He entered railroad service in April, 1903, with the Pittsburgh & Lake Erie, as timekeeper in the office of the master car builder, and became gang foreman in November, 1904. Mr. Lang served as assistant general foreman of car shops from November, 1907, until July, 1915, when he was appointed general car inspector. In January, 1925, he became assistant master car builder, which position he was holding at the time of his recent appointment to the position of master car builder.

MARVIN E. WILCOX, who has been appointed assistant superintendent of car maintenance of the Boston & Maine, with headquarters at Boston, Mass., was born on July 26, 1898, at Buffalo, N. Y., and was educated in the Buffalo, N. Y., the Cleveland, Ohio, and the Hammond, Ind., public schools. He entered railway service in 1912, with the Chicago, Indiana & Southern and the Indiana Harbor Belt (jointly), both of which are now parts of the New York Central, beginning as a car repairer for the Indiana Harbor Belt and remaining with that company until the time of his recent appointment. Mr. Wilcox served also as assistant shop foreman and foreman of car inspectors of the Indiana Harbor Belt, Gibson, Ind.


M. E. Wilcox

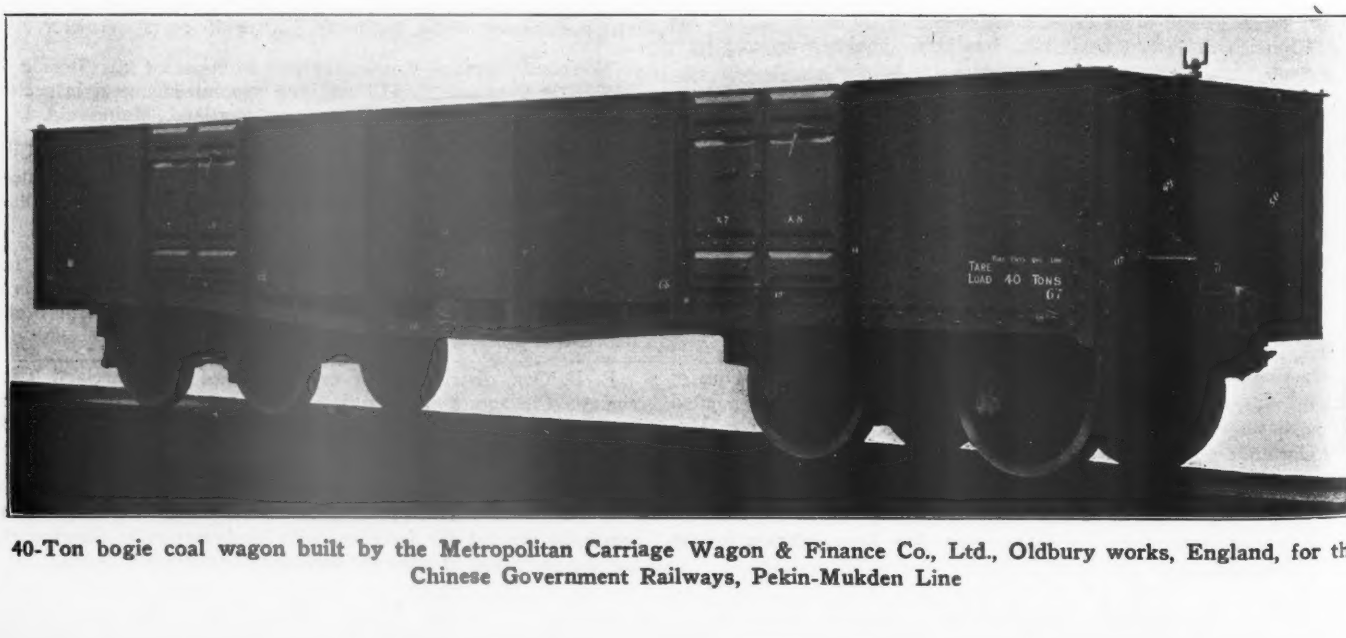
Purchases and Stores

V. J. CROW has been appointed division storekeeper of the Southern, with headquarters at Columbia, S. C., succeeding J. B. Lowd, resigned.

R. A. LIVENGOOD, division storekeeper of the Southern at Charlotte, N. C., has been appointed storekeeper, Charlotte roadway shop, with headquarters at the same place.

Obituary

IRA S. DOWNING, general master car builder of the Cleveland, Cincinnati, Chicago & St. Louis who died on January 15 at his home in Indianapolis, Ind., was born at Bentonville, Ohio, February 1, 1869. He received a common school education and his first railroad experience was obtained on the Pere Marquette, at Toledo, Ohio. In February, 1892, he entered the employ of the Lake Shore & Michigan Southern, and from November, 1904, to September, 1913, was master car builder of that road. He became general master car builder of the C., C., C. & St. L. in September, 1913.



40-Ton bogie coal wagon built by the Metropolitan Carriage Wagon & Finance Co., Ltd., Oldbury works, England, for the Chinese Government Railways, Pekin-Mukden Line